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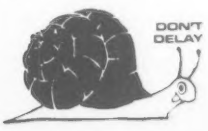

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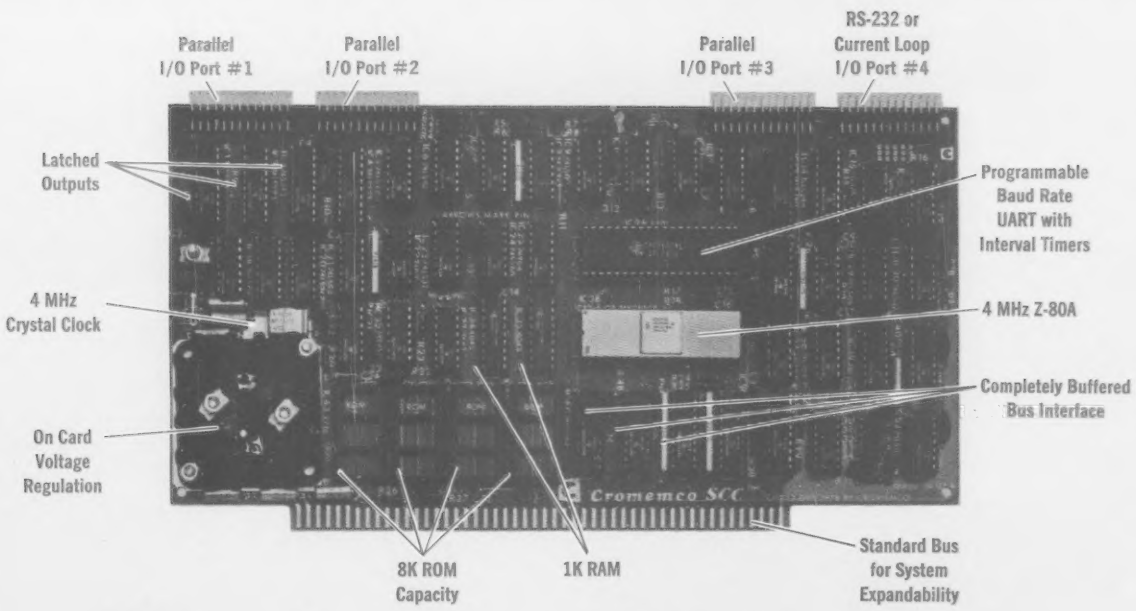

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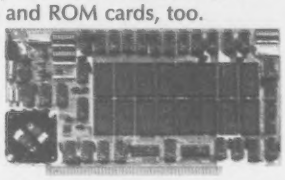

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What every educator should know about desk-top computers.

It's easy to get into classroom computing. What's tough is to do it right. With so much talk about computers in the classroom, educators like yourself want all the facts before they recommend any system for classroom use. That's why Apple Computer's new "Curriculum Materials Kit" can help, with answers to your questions and some very important data you may not have considered before.

Who uses desk-top computers.

Hundreds of innovative educators have already discovered the Apple Computer for instructional applications from kindergarten through college. Apple gives you computer-assisted instruction capabilities, including drill and practice, tutorial, problem-solving, games, simulations, and more.

Apple engages student interest with sound and color video. In fact, your students will be able to write programs and create high-resolution graphics. And you can use your Apple for testing, counseling, even classroom data processing. That's just the beginning.

What to look for.

Once you've unlocked the power of the desk-top computer, you'll be using Apple in ways you never dreamed of. That's when the capabilities of the computer you recommend will really count. You don't want to be limited by the availability of pre-programmed cartridges. You'll want a computer, like Apple, that you can also program yourself. You don't want to settle for a black and white display that limits you to just putting words and numbers onto the screen. You'll want a computer, like Apple, that can turn any color tv into a dazzling array of color graphics.* The more you and your students learn about computers, the more your imagination will demand. So you'll want a computer that can grow with you as your skills and experience grow. Apple's the one.

How to learn more.

The quickest way to learn more about desk-top computers is to request your free copy of Apple's Curriculum Materials Kit (specify level). Get yours by calling 800/538-9696; in California, 408/996-1010. Or by writing us. Then visit your local Apple dealer. We'll give you his name and address when you call.

*Apple II plugs into any standard TV using an inexpensive modulator (not included).

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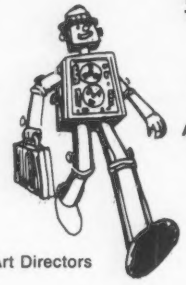

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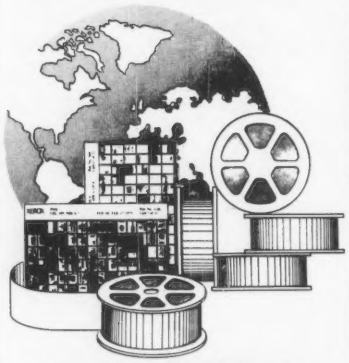

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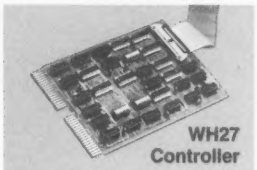
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Needed will be a text editing - word processing program to handle the storage, retrieval, and updating of reference notes relating to the various Bible verses.

Once the data base and the programing is established, it should be possible to use it to cross check references and comments to see if there are any Bible verses to support or oppose a given subject under consideration. Another possible use could be the use of the original Greek and Hebrew texts to check out Translation accuracy and other problems.

If you are interested in taking part in this effort, or know of someone who would be interested, or if you know where some of the above goals have already been accomplished, please contact Mr. Larry E. Ellison, 19 Huntington Lane, Willingboro, N.J. 08046

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Employment Register

The Seventh Annual Computer Science Employment Register will be conducted at the ACM Dayton Computer Science Conference on February 20 -22, 1979. This Register, the only one of its kind,aids in matching computer scientists and data processing specialists with employer opportunities. These listings have received wide exposure. In addition to being reviewed by conference attendees, after each conference many copies of the register books have been placed on display in libraries, computer science departments and other convenient locations.

The purpose of the Register is to provide a mechanism for establishing contact between applicant and employer in a professional manner. Both applicants and employers must file their registration giving pertinent identifying information on official forms. Three different forms will be used: (1) applicant, (2) academic, and (3) business, industry and government. These forms or more information on the Register may be obtained from:

Orrin E. Taulbee
ACM Computer Science Employment Register
Department of Computer Science
University of Pittsburgh
Pittsburgh, Pennsylvania 15260

Closing date for acceptance of forms is January 30, 1979. The inclusion of a late form can not be guaranteed. Charges for Applicants are: Free for student, $5. for non-student, and $10 for anonymous. Employers are charged $30 and personal copies of one of any of four books of listings produced are $25.

(Our Face is Red Dept.)

High-Resolution Graphics for the Apple II Computer, which appeared in our July-August 1978 issue, was actually done by David Ramsey and Dennis Freeze, and not by Gary Dawkins as originally credited. We highly recommend that program authors verify that they really **are** program **authors** before submitting programs. We sincerely regret this error.

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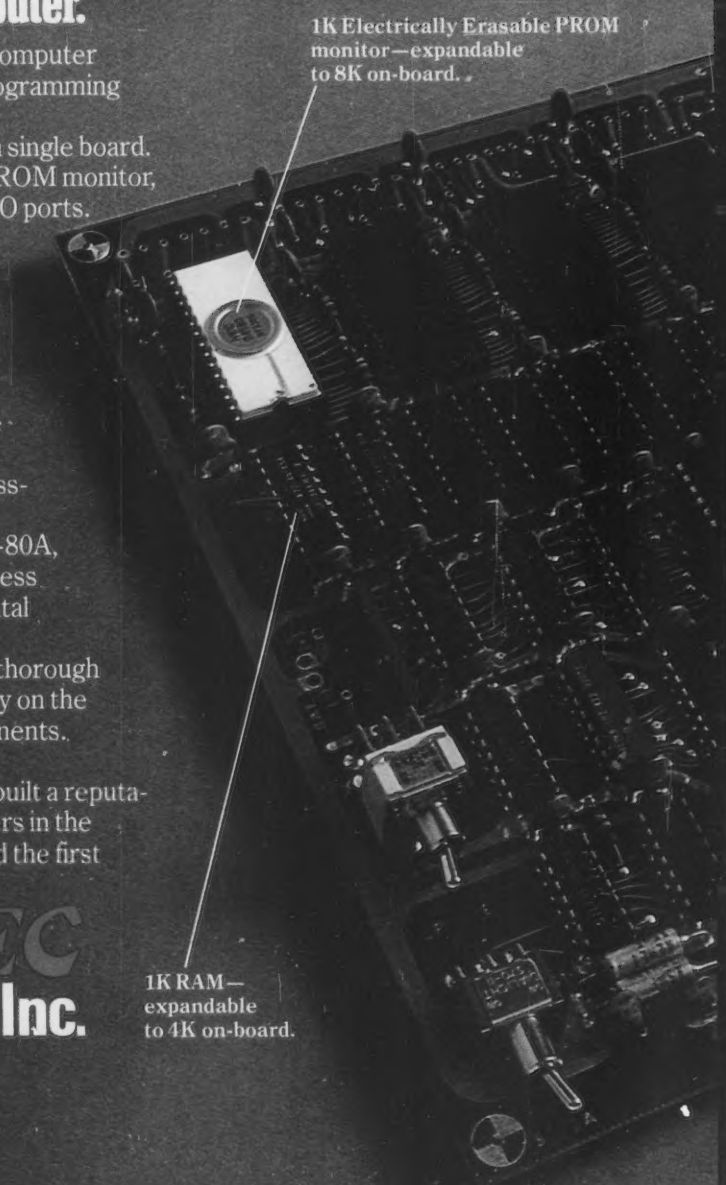

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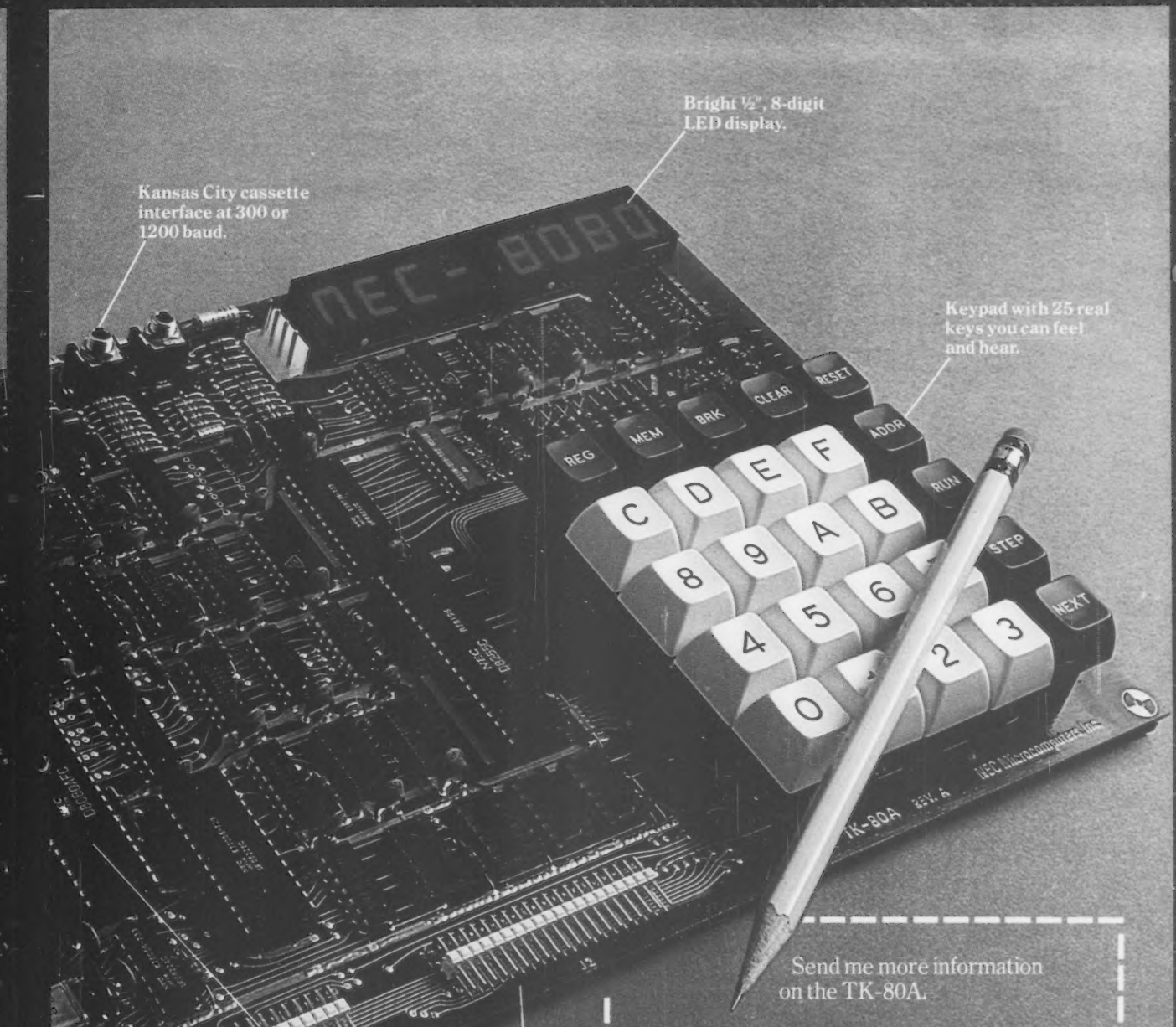

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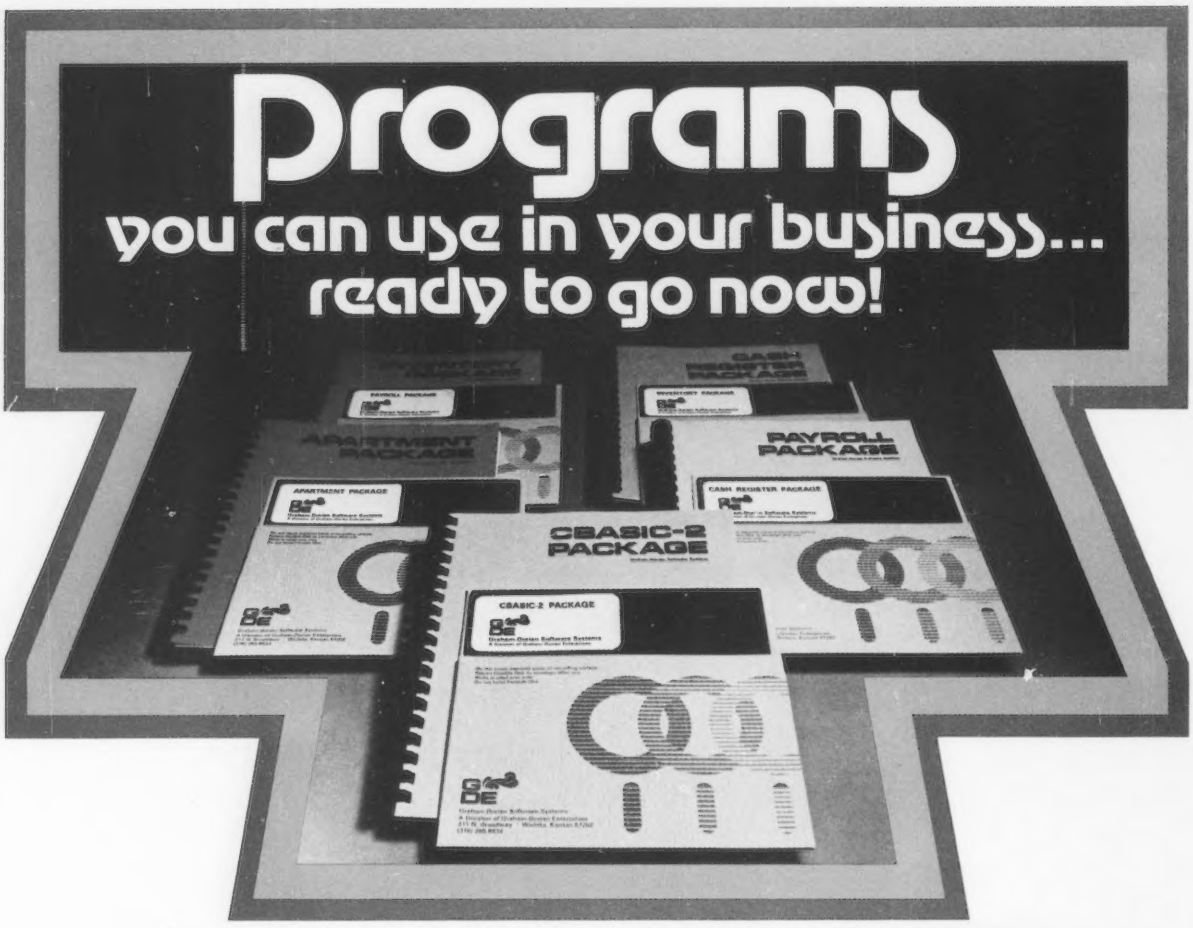

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put...input/output...in

The Last Word On The Polish "Problem"

Dear Editor:

I fear that I cannot let Mr. Kowalski's letter in the July/August issue pass without comment. If Mr. Kowalski (Esq.) is so intent on bettering the lot of the Polish-Americans (who, as a group, are not in such bad shape anyway), let his organization spend its time lobbying congress to open all of the minority small business assistance programs to Polish-American owned small businesses instead of pouring through periodicals in a paranoid search for something at which to take offense. Heaven forbid he should ever come across an article on reverse-polish notation lest he complain that it is an insinuation that Polish-Americans are backward!

On second thought, Mr. Kowalski, forget the lobbying. We're doing quite well without federal assistance and federal strings.

Richard A. Milewski
President
The Software Works, Inc.

P.S. Did you hear the one about the Polish computer that uses base one arithmetic?

Not Really Complaining, But...

Dear Editor:

Your Jul-Aug 1978 issue seems to bring me a feeling of mixed blessings (such as seeing your mother-in-law go over a cliff in your new car). Congratulations on your purchase of ROM, however if I had wanted a subscription to it I could have purchased it (subscription) by myself. I intend to imply that I had no particular desire for it.

Congratulations on upping publications to once a month, however your deal of cutting my 3 year subscription in ½ also does not seem too neat. My copy of the order form shows that I subscribed for a period of time instead of a number of issues — even though the form did say bi-monthly. This is not intended to imply that I only wish to get every other issue for 3 years. I do enjoy your publication and want all issues (I purchased all back issues).

I really do enjoy your publication and feel very hesitant in voicing these concerns, but I would rather that you had the opinion even if it is 1/56,000 of your circulation.

John K. McCandliss
GC0471721D24039

On the first point we don't have a problem. This will be the last issue with the ROM supplement (because we've run out of ROM material). On the second point (going monthly) we don't have a problem, either. You've covered the situation quite well, along with all the alternatives, and all I can say is, don't worry you'll be getting your money's worth in the issues ahead.—JTC.

Help For The Handicapped: Thru Micros

Dear Editor:

The Spain Rehabilitation Center at the University of Alabama Medical Center has a project underway to demonstrate both the utility and economic feasibility of the new generation of 'personal' computers for use by the severely disabled. The programmability of the computer will allow it to serve as a general purpose appliance to be used as an aid to communication and education as well as for environmental control and entertainment.

This system, as currently envisioned, will consist of a microcomputer, an on-line storage device for programs and data, two T.V. monitors for user feedback and information display, a printing device for typed output, a speech recognition device for vocal input of commands, data, and text, a powerline controller for environmental control and a telephone dialing/answering device. We are attempting to select components which are widely distributed and serviced as well as being plug compatible and economically priced.

Programs will be written or purchased to perform specific functions in each of the areas mentioned above. However, we would be very interested in receiving ideas from your readers, particularly those who are disabled, those who have disabled friends or relatives, and those who have personal computers and would like to develop hardware or software for the system on their own, regarding specific functions which they would like to see developed and which could be accommodated by the proposed micro-computer system.

We are looking forward to receiving input from anyone who may be interested in this project.

Charles Healey
Research Associate
Spain Rehabilitation Center
U.A.B. University Station
Birmingham, AL 35294
(205) 934-3320

I think it's about time someone involved in this field (micros for the handicapped) sat down and wrote an article for Creative...describing the advances which have been made and some of the goals. Using personal systems to help the disabled is certainly a worthwhile effort and those who can provide meaningful input to such projects should.—JTC.

put...input/output...in

Looking Like Who?

Dear Editor:

Creative Computing is looking more and more like *Byte, Kilobaud* and all those other microcomputer magazines. I miss the great diversity it once had.

David Gross
University of Washington, HG-45
Seattle WA 98195

Investment Analysis...Coming Up!

Dear Editor:

My compliments on your May/June '78 issue. It was by far your best yet. I particularly like the Black Box game program which I modified to run in Radio Shack Level I Basic.

On April 17th the Wall Street Journal ran an article on the use of personal computers for investment analysis (p. 34). That article stated that "in a recent survey, 63% of the readers of Creative Computing Magazine said they were interested in investment analysis by computer." After reading that statement I'm looking forward to several good articles on the subject in your magazine.

I've enclosed the statements which require alteration and/or addition to make the Black Box program run in Level I:

Thomas McDowell
6544 Lutes Cir.
Ft. Bliss TX 79906

Black Box RS Level I Basic

```
10 DELETE
100 IN. "NO OF ATOMS"; B
110 A=0 : FOR X=1 TO 100 : A(X)=0 : N.X.
120 X=RND(8) : Y=RND(8)*10 : Z=X+Y:
IF A(Z)=0T.A(Z)=1:A=A+1
130 IF A < BT. 120
140 DELETE
  •
  •
  •
300 K=X+U: L=Y+V
310 IF U=0T. I=K-1: J=K+1: C=L : D=L : G.330
320 C=L-1 : D= L+1 : I=K: J=K
330 ON8*A(K+10*L)+A(I+10*C) +
2*A(J+10*D)+1G.400, 410, 420, 410
  •
  •
400 X=K : Y=L : G.500
  •
  •
  •
700 P.: FOR E = 1 TO 8 : FOR F = 1 TO 9
710 IF F = 9 T.P. "  " : G. 800
720 IF A (E*10 +F) =0 T.P. "."; : G. 800
730 P. "*";
800 N.F : N.E
```

I'm sure there are many readers looking forward to some good articles on investment analysis in Creative. It is, after all, a very practical application for a personal computer. The "problem" lies in getting authoratative, high-quality material from someone willing to share it with all of us. We're interested.—JTC.

TRS-80 Input Strangeness

Dear Editor:

I have two criticisms of Radio Shack TRS-80 Level II BASIC that I thought your readers might like to know about. The first is a real bug as far as I am concerned. If INPUT AS is executed and the ENTER (or RETURN) key is pressed, you would expect AS to contain the null string. But that is not how it works in Level II; instead, the input is ignored, and AS contains whatever it contained before the INPUT statement was encountered. So for example, the following program

```
10 INPUT AS
20 PRINT AS
30 GOTO 10
```

runs like this:

```
?JIM          followed by ENTER (or RETURN)
JIM
?             the user just typed ENTER
JIM
```

Some people won't worry about this, but it can be a difficulty for any program that asks the user to give a response by just hitting the ENTER key. This is a handy way to minimize typing at the terminal.

There is a way around this by initializing your variable. This program does what you would expect:

```
10 AS = " "
15 INPUT AS
20 PRINT AS
30 GOTO 10
```

Still, this is a cheap way out, and the performance of INPUT does not match what is described in most books on BASIC.

The second complaint I have concerns INKEY. The basic concept is good. INKEY is valuable in allowing people to write programs that interact with people in real time, and so is especially nice for graphics games. Or so I thought until I tried to program a real-time version of LANDER, the game where you attempt to land on the moon without crashing. My idea was to used INKEY to let me control the burn of my rocket. I thought that if I put INKEY in the right sort of loop that my program would strobe the key board to tell whether the rockets should be on or off. But things didn't work out as I expected. If you hold down the "R" key, then the first time AS=INKEYS is executed, AS contains "R", but unless the key is **repressed,** AS will contain the null string the second time AS=INKEYS is executed **even though the** "R" **key is being held down** at the time.

The following program illustrates what I mean

```
10 AS=INKEYS
20 PRINT AS
30 GOTO 10
```

If you run it while holding down the "R" key, the output is

```
R
        lots of null strings

.
.
.
```

I think the output should be

```
R
R
R
.
.
.
```

where R comes out until the "R" key is released.

Now I can get what I want if I am willing to use **two** keys (one to turn rockets on, the other to turn them off) or if I want to rig it so that the first press turns them on, and the second press turns them off. However, the most natural way to control a rocket is to press the key (and hold it down) during the time you want the motors on, and to release it when you want the motors off. I can't think of any way to get this to happen with the present version of INKEY. Can your readers think of any applications of INKEY where the present version has any advantages? If my version (call it KEYS) were used, you could still get the effect of the present INKEYS. For example, this

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program would behave like the previous one by outputting the key pressed and then a lot of null-strings:

```
 5 F=O
10 AS=KEYS
12 IF F= THEN AS=" "
14 F=1
20 PRINT AS
30 GOTO 10
```

But I challenge anyone to get exactly the effect of KEYS using INKEYS. (Remember KEYS puts the null string in a variable only when no key is depressed at the time, **it is executed.)**

Generally Level II BASIC is rather nice, though there are some features of Level I I miss (for example messages that indicate the **position** of a syntax error and abbreviated commands). Still, I think more thought should have been put into how the IO subroutines were written.

James W. Garson
University of Notre Dame
Notre Dame, Indiana 46556

Your "bug" in the Level II INPUT statement is probably intentional, since the other 8080/Z80 versions of Microsoft BASIC do exactly the same thing. It's hard to understand why this feature was implemented, though.

INKEY$ works exactly like the single-character GET verb in Commodore PET BASIC. As you point out, you can't really use INKEY$ to decide if a key is physically pressed at any given moment, but quite often you do want to read the keypress just once. For instance, in a Hangman game, you want the player to enter his letter one time only. With INKEY$ this is very easy, but if it returned a value as long as the key was held down, then you would have to test to see if a key was depressed, then read it, and then wait until the key was released. So, there are advantages to both methods. Sometimes it is possible to determine if a key is currently depressed by PEEKING around, but I don't think that aspect of the TRS-80 is documented even if it exists.

Radio Shack did leave out two rather important features in Level II: DEF and RENUMber. DEF is even in all the Microsoft 8K BASICs, and is essential in many mathematical and engineering applications. RENUMber is a **must** in any language where line numbers are used for program editing and statement references. These are available, though, when you add the expansion interface and get Level III. — Steve North

Social Science Buffs, Some Help Please

Dear Editor:

I am at work on a book on computers for social-science students and other non-mathematical types who might have occasion to use computers in their work but don't know how to go about it.

I need examples of creative uses for large or small computers in history, political science, economics, psychology, linguistics and other social-science areas. I can't repay you with anything other than a "Thank You" and a mention, but if that's enough, send your idea to Roland Parenteau, 2007 Turner St., Richland, WA 99352.

Roland Parenteau
2007 Turner St.
Richland WA 99352

Apple Speed!

Dear Editor:

A good sort algorithm is worth its wait in microseconds. With this in mind I set up a comparison of several sorts from *Creative Computing* on my APPLE-II. I chose the Shell-Metzler, butterfly-Hart and heapsort, programmed in APPLE integer basic. In sorting random ten character words, all sorts seemed to give approximately the same results for up to 500 words. But at 1000 words, the butterfly-Hart and heapsort distinguished themselves. To get a feeling for the differences in processing speeds between the various languages supported on my APPLE-II, I decided to compare the Shell-Metzler sort (because of its compactness) in APPLE integer Basic, sweet-16 (a 16-bit interpreter), and 6502 assembler. As you can see, sweet-16 was 4 times faster than Basic, but the 6502 routine ran away with the show. It ran so fast, I had to rerun it to verify that it worked. So, if you have an often used long running subroutine, program it in assembler!

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BUTTERFLY-HART	2	38	266	606
HEAPSORT	1	35	261	600
S-M(SWEET-16)	0-1	4	46	158
S-M(6502)	0-1	0-1	1	3

Gary A. Foote
127 Mt. Spring Rd.
Tolland, CT 06084

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Simple but powerful.

Built around an RCA COSMAC microprocessor, the VIP is a complete computer system that can grow with you. It has 2K of RAM, expandable on-board to 4K. Plus a ROM monitor, audio tone output to a built-in speaker, power supply, and 8-bit input and output ports for control of relays, sensors, or other peripherals.

Soon RCA will offer options for color graphics and 256 tone sound generation. An optional auxiliary keyboard will open up an exciting world of two-player games.

Take the first step now.

Check your local computer store or electronics distributor for the VIP. Or contact RCA VIP Marketing, New Holland Avenue, Lancaster, PA 17604. Phone (717) 291-5848.

*Suggested retail price. Does not include video monitor or cassette recorder.

The fun way into computers.

RCA

CIRCLE 169 ON READER SERVICE CARD

North Star Systems Go To Work

More and more, you see the North Star HORIZON computer at work: in business, research, and education. Its high performance qualifies the HORIZON for demanding professional applications. Over 10,000 users during the past two years have proven that North Star hardware has the reliability for day-in, day-out computing. The HORIZON is now a serious candidate for any small system installation.

SOFTWARE IS THE KEY TO HORIZON MATURITY

North Star BASIC and DOS have been used to develop hundreds of commercial program packages. These packages establish that North Star software has the completeness and convenience necessary for serious program development. Because of the many independent vendors offering software using North Star BASIC and DOS, the HORIZON owner now has the widest selection of software in the microcomputer industry! Software available includes: word processing, general ledger, accounts payable/receivable, mailing list processing, inventory and income tax preparation. Program development systems such as assemblers, debuggers, editors, PILOT and FORTRAN are also available.

EXPAND YOUR HORIZON

The basic HORIZON computer includes a Z80 microprocessor, 16K bytes of RAM memory, an I/O interface and one Shugart minifloppy disk drive. The HORIZON can be expanded to 60K bytes or more of RAM, three disk drives, and three I/O interfaces. Performance can be enhanced by the addition of the North Star hardware floating point board. Also, S-100 bus products from other manufacturers may be used to expand the HORIZON.

For more information, contact your local computer store.

NORTH ★ STAR COMPUTERS

2547 Ninth Street
Berkeley, California 94710
(415) 549-0858

CIRCLE 163 ON READER SERVICE CARD

COMPLEAT COMPUTER CATALOGUE

We welcome entries from readers for the "Compleat Computer Catalogue" on any item related, even distantly, to computers. Please include the name of the item, a brief evaluative description, price, and complete source data. If it is an item you obtained over one year ago, please check with the source to make sure it is still available at the quoted price.

Send contributions to "The Compleat Computer Catalogue," *Creative Computing*, P.O. Box 789-M, Morristown, NJ 07960.

MAGAZINES, JOURNALS

DUMP PUBLICATIONS

Here's a unique software publication for Users of the Radio Shack TRS-80 Micro Computer System. DUMP, Devoted Entirely to the TRS-80 User, is a monthly periodical incorporating news, information and running software ready to load from a 33-1/3 RPM DUMP Disk record.

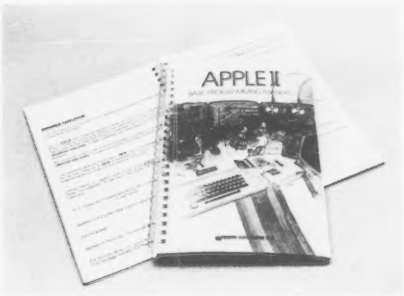
The DUMP Disk can be loaded into the TRS-80 system with the use of an ordinary phonograph. This new software medium has been developed to provide the user with the most permanent and efficient method of program storage.

Each issue contains a wide variety of programs from finance and education to games and machine language. Programs are provided with complete documentation and line editing information for Level I and Level II Basics.

A 1 year subscription costs $20.00.

For more information, contact DUMP Publications, P.O. Box 2454, Jacksonville, FL 32203, 1-800-874-4500.

CIRCLE 176 ON READER SERVICE CARD

VENDOR LITERATURE

APPLE II BASIC PROGRAMMING MANUAL

The new APPLE II BASIC PROGRAMMING MANUAL was authored by Jef Raskin, a computer professional who has written and lectured extensively on the subject of computer science to both the novice and the professional.

Created with foremost concern for the reader, the book assumes no prior background in programming or computers. Programming is explained in everyday English with no computer jargon used. Moreover, with scrupulous attention to detail, the book introduces the whole computer to the reader. Thus unlike programming manuals that solely teach a language, this book teaches a language in the context of the computer in which it will be executed.

The manual is comprised of four chapters. Chapter 1 guides the reader through the details involved in connecting the various Apple II system elements, television, tape cassette player, etc., and describes the computer's control functions. The second chapter starts the reader programming with the BASIC Programming Language using simple colorful examples. Chapter 3 moves the reader into writing complete BASIC programs by providing detailed information on most BASIC language commands. Finally, the last chapter describes strings, arrays and subroutines for the reader who has acquired an understanding of the BASIC language and is ready to write more extensive programs.

Throughout the manual there is a conscious attempt to supply information on the BASIC language in an entertaining, thought provoking manner, and to foster a programming style.

The manual is presently available from Apple dealers for $5.95 each and is supplied free of charge with each Apple II computer.

CIRCLE 177 ON READER SERVICE CARD

THE CHANNEL DATA BOOK

Channel Data Systems will publish a comprehensive hardware/software reference service for users of the Commodore PET™ personal computer. The Channel Data Book is a user-oriented directory of PET-related products including:

*Software
*Hardware and Peripherals
*Literature and Periodicals of special interest to PET users
*Listings of user groups and distributors
*Cross references by product type and supplier

Designed as a personalized working tool, the Channel Data Book provides a complete reference service for PET-related products, plus convenient dividers and color coding to organize programs, articles and newsletters of specific interest to each user. Special sections for filing correspondence you have received from Commodore and flyers from other product suppliers are also provided. Flyers from suppliers of PET-related products who elect to advertise in the Data Book will be included in product sections. Venders that market PET-related products or services should be sure to contact CDS, as a summary of the information will be included at no cost.

The Data Book includes an attractive 3-ring binder and updated supplements with easy to follow instructions for filing new and revised material. The low price of $19.95 includes the Channel Data Book and update service through calendar year 1979.

Channel Data Systems, 5960 Mandarin Ave., Goleta, CA 93017 (805) 964-6695

CIRCLE 178 ON READER SERVICE CARD

ORGANIZATIONS

MITS (TM) MINI-FLOPPY DISC USER'S GROUP

Those interested should send a self-addressed-stamped-envelope to:

AAA Computer Services, P.O. Box 2742, Appleton, WI 54911.

The group is planned to be not-for-profit and will act as a clearing house for software for the new mini-floppy.

CIRCLE 179 ON READER SERVICE CARD

CLUB FOR RCA 1802 COSMAC

A new club to support the RCA 1802 COSMAC is QUESTDATA. Owners of Elf, Super Elf, Elf II, COSMAC VIP, COSMAC Development System or Homebrew 1802 will find many programs, applications and experiments for their microcomputer in each issue of QUESTDATA.

QUESTDATA will be showing the complete RCA instruction set and how to build interesting programs for: graphics, control, games and business purposes. Coverage will be given to Tiny BASIC, Elf Expansion possibilities (memory, cassette I/O, etc.) light pens, reader questions and music programs.

QUESTDATA offers users the growth possibilities which all Elf systems provide. The $12 monthly QUESTDATA will give your Elf's memory some microcomputer brain food. Foreign subscriptions, with the exception of Canada and Mexico, are $6 extra for mailing.

QUESTDATA, P.O. Box 4430, Santa Clara, CA 95054.

CIRCLE 180 ON READER SERVICE CARD

COMPUTERS

SYSTEM THREE COMPUTER

The System Three from Cromemco is ideal for a wide range of professional work in almost any field, including engineering, science, business/accounting, word processing, data-based management, education, medicine and similar work.

The System Three consists of a fast, powerful, 4-MHz Z-80 based microcomputer, 32-kilobytes of RAM (two 16K cards) expandable to 512 kilobytes, an RS-232 interface, a parallel printer interface, a CRT terminal with line editing and block mode transfer capabilities and a fast line printer with 132 columns.

System Three is available with a number of options including a PROM programmer for development work, an additional dual disk drive and additional memory. With the optional second disk drive, System Three provides a megabyte of disk storage.

Cromemco also provides broad software support for System Three. Currently available software includes a FORTRAN IV compiler, a 16K Z-80 BASIC and a Z-80 MACRO Assembler and Linking Loader. All software is available on standard, IBM-format, softsectored diskettes.

The System Three mainframe is available for $5990. The additional CRT is available in two models for either $1595 or with expanded capabilities including line editing and block mode transfer for $1995. The additional line printer is also available in two models including a fast, 180 character/second model for $2995 and a 60 character/second model for $1495.

For more information, contact Cromemco, Inc., 280 Bernardo Avenue, Mountain View, CA 94040; (415) 964-7400.

CIRCLE 181 ON READER SERVICE CARD

APF INTRODUCES PECOS I

APF Electronics, Inc., New York, introduces PeCos I, a complete personal computing system incorporating comprehensive math capabilities, exceptionally large memory and ease of programming in the most English-like computer language ever devised.

PeCos I, short for PErsonal COmputing System, is a fully integrated computing system. It combines a 9″ CRT, a standard size 60-key keyboard and dual cassette decks. PeCos I is available now for just $1695 suggested retail.

The easy-to-learn PeCos language makes it possible for almost anyone to use the computer without lengthy training in a complex language. PeCos language is a derivative of the JOSS® language developed by Rand Corporation and is the most English-like computer language ever devised. Users have found that PeCos language is much easier to learn and program than BASIC.

PeCos I has a math program that's remarkably comprehensive for a unit so inexpensively priced. It permits full computation in nine-digit floating decimal arithmetic with a number range from 1×10^{99} to 1×10^{-99}. PeCos I has built-in all the functions of a programmable calculator and much more — including trigonometry, number dissection, string concatenation, transcendental and the ability to define functions.

PeCos I also is provided with 24K ROM and 16K RAM internal. It has unique built-in dual cassette decks that are semi-automatically controlled. The cassette decks use standard audio cassettes which can each store up to 80K bytes of information. It is possible to read from one tape and write to the other. Tape operations are done at a speed of 800 baud.

The self-contained system is all that is needed to be up and running in the home, office, laboratory or school. Everything required to operate is included standard: the 60-key, full-size keyboard with 110 codes and upper and lower case; the 9″ CRT displaying 16 lines of 40 characters each with automatic scrolling and speed control; built-in dual cassette decks; 6502 microprocessor; power supply; and an RS-232 transmit port for interfacing a serial printer.

For more information, contact APF Electronics, Inc., 444 Madison Avenue, New York, New York 10022; 212/758-7550.

CIRCLE 182 ON READER SERVICE CARD

HEWLETT-PACKARD INTELLIGENT TERMINALS

A new low-cost graphics CRT terminal that is programmable in a high-level language and offers new ease of operation and flexibility in graphics applications is Hewlett-Packard's entry into the intelligent terminals market. The top-of-the-line HP 2647A graphics terminal, which also offers full interactive alphanumeric capability, features multiple display workspaces, shares output peripherals, displays data as graphs, pie or bar charts and provides dot-by-dot hardcopy of its screen display with optional companion plotter/printers.

PROGRAMMABLE IN BASIC

Using a subset of HP BASIC in the HP 2647A raster-scan graphics terminal, the unit's operational characteristics can be tailored to meet specific needs of users to solve a variety of problems in engineering, scientific and business environments.

By sharing intelligence with the microprocessor-controlled terminal, a host computer's resources are freed for more complicated tasks saving computer time and communications costs. The terminal accepts BASIC programs that are downloaded from the host CPU and then executes them under local control. With BASIC, the terminal's graphics and alphanumeric functions and facilities can be modified, output from a computer can be changed into formats defined by the user and the keyboard can be

reconfigured by assigning each key a different code. With such flexibility, no software changes may be required to adopt "canned" programs to users' applications.

The BASIC used in the terminal has integer and floating point numbers, string variables, string arrays, array variables, trig functions including natural log, callable subroutines and parameter passing. An optional interface also enables up to four terminals to share the same plotter or printer to save the cost of using several such output devices.

The new HP 2647A is compatible with programs developed for the HP 2648A—HP's first graphics terminal. It offers all the capabilities of the earlier terminal including independent graphics and alphanumeric memories, a bright display of 360 x 720 individually addressable points, selective erase, system-independent zooming and panning, and rubber-band line drawing that can be used without CPU support.

The terminal has 64K bytes of random-access memory (RAM) for BASIC, 32K bytes of RAM for graphics and 56K bytes of read-only memory for terminal control functions.

OPTIONAL HARDCOPY

High-quality, vector-drawn hardcopy for the terminal can be provided by both the HP 9872A multi-color graphics plotter and the HP 7245A plotter/printer. A newly introduced option to the HP 7245A enables users to get a dot-by-dot hardcopy of the HP 2647A graphics display memory. Price of the HP 9872A is $4,200, while the HP 7245A is priced at $4,600. The new option adds $250 to the plotter/printer's base price. (U.S. prices only.)

PRICE AND DELIVERY

The Hewlett-Packard 2647A intelligent graphics terminal is priced at $8,300 (U.S. price). First deliveries are scheduled for July.

For further information: INQUIRIES MANAGER, Hewlett-Packard Company, 1507 Page Mill Road, Palo Alto, California 94304.

CIRCLE 183 ON READER SERVICE CARD

ATTENTION
APPLE II OWNERS

Southeastern Software announces ready to run programs on tape for your computer . . .

Send $5.95 plus 50¢ postage and handling for demo tape and sample newsletter designed for Apple II owners.

Demo tape includes 1 game and 2 general interest programs. Specify if you want tape to run in BASIC, Applesoft or Applesoft II.

SOUTHEASTERN SOFTWARE
Dept. CC 7270 Culpeper Drive
New Orleans, LA 70126

CIRCLE 142 ON READER SERVICE CARD

RCA REDUCES PRICE ON VIP HOME COMPUTER

The price on the fully assembled RCA VIP (Video Interface Processor) home computer has been reduced to $249.00 from $299.95, effective June 1, 1978, according to Richard Simpson, VIP product marketing manager.

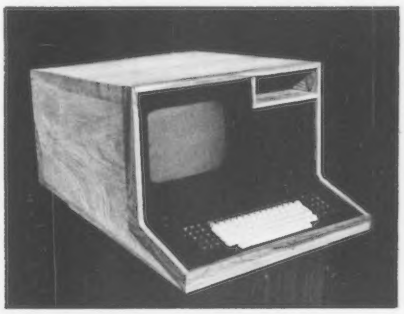
"The reduced price is possible because of increasing production volume and declining costs for 4K static RAMs used in the VIP," Simpson said.

He also noted that RCA will emphasize availability of the fully assembled home computer. The previously available kit version will only be offered on special arrangement. "Because of the simplicity of VIP's programming language and the ease with which a novice can learn to program, the VIP is very attractive to people inexperienced with personal computers. Thus, Simpson stated, we are trying to eliminate frustrations and perplexing problems that might be inherent in a novice's efforts to assemble a kit."

The VIP is a microcomputer based on the RCA COSMAC (CDP1802) microprocessor, and is designed to interface directly with a video monitor or modified TV set. It is provided with an interpretive language which makes it easy for the user to write graphic games and other applications without having to learn machine language. The VIP contains a sixteen-key keypad for entering programs and has a built-in audio cassette interface to permit storing programs on a cassette. Documentation provided with the VIP contains listings for twenty games for use on the system.

For further information, call Rick Simpson (717) 291-5848, or write RCA COSMAC VIP Marketing, New Holland Avenue, Lancaster, PA 17604.

CIRCLE 184 ON READER SERVICE CARD



85/P = 8085 + PASCAL

The new 85/P, programmers workbench from Northwest Microcomputer Systems, Inc., combines the throughput of the 3MHZ Intel 8085A and the power of Pascal.

The standard system features: 8085A CPU, a PASCAL compiler/interpreter, CP/M* supporting Basic, COBOL (July) and Fortran, Direct Memory Access, two Shugart floppy disc drives with one megabyte of on-line storage, 54K of 450ns user available static Ram, a Hall Effect Keyboard with 103 keys, two serial ports (RS232C), two parallel ports (16 bits), 24 x 80 character 12" video display, all enclosed in a single cabinet.

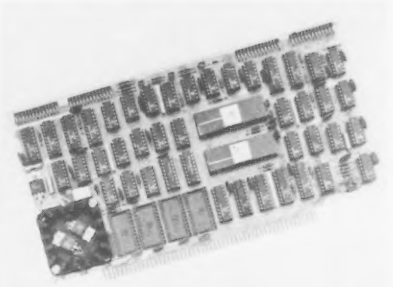
The 85/P gains its efficiency in program preparation and code execution from the increasingly popular Pascal language. The 85/P provides the full Pascal environment including a 725 lpm compiler/interpreter, random and sequential files, a screen oriented editor, interactive source-linked debugger, plus full documentation and a 90-day warranty.

Pricing for the complete system is $7495.00. Delivery is quoted at 30 to 60 days. A variety of other packages are available also, including a screen-oriented accounting package and a word processor.

For more information please contact Northwest Microcomputer Systems, Inc., 121 E. 11th, Eugene, OR 97401, (503) 485-0626.

*CP/M is a registered trademark of Digital Research.

CIRCLE 185 ON READER SERVICE CARD



4 MHz SINGLE CARD COMPUTER

Cromemco's Single Card Computer is a complete computer which brings the power of the Z-80 and the flexibility of the S-100 bus to the dedicated computer environment.

The card offers 4 MHz operation, 8K bytes of on-board 2716 PROM, and 1K byte of static RAM memory. This stand-alone card also provides an RS-232 (or 20mA current loop) serial interface with programmable baud rates to 76,800, vectored interrupts, 24 bits of bidirectional parallel I/O, and 5 programmable timers. Only a power supply and PROM software are required for operation. The Single Card Computer is compatible with all Cromemco cards.

The Single Card can also be the core of an enormously expandable S-100 bus system that can include additional memory, I/O, or even floppy disk drives as required.

Cromemco's Z-80 Monitor and 3K Control BASIC are available in 2716 ROM for use with the Single Card Computer. With these two ROMs, the single card computer can be used immediately without any additional memory or I/O. The Monitor has 12 commands to aid in program development. The 3K Control BASIC has 36 commands/functions and can directly access I/O ports and memory locations as well as call machine language subroutines.

The Single Card Computer is available in kit for $395 and assembled and tested for $450. The Monitor and Control BASIC are available in two ROMs for $90.

For additional information, please contact Cromemco, Inc., 280 Bernardo Avenue, Mountain View, CA 94043, (415) 964-7400.

CIRCLE 186 ON READER SERVICE CARD

PERIPHERALS

FIRST INTEGRATED S-100 DISK/TAPE CAPABILITY

A new double-density floppy disk storage system, the DELTA-1, has been introduced by MECA, manufacturers of the ALPHA-1 mass storage tape unit. The DELTA-1 uniquely provides up to 200K bytes of storage on a single 5¼" drive.

Included with the DELTA-1 disk system is the MFM S-100 Disk Controller which supports up to three SA-400 disk drives. MECA customers who now own an ALPHA-1 Tape System can use the MFM Disk Controller to combine the ALPHA-1 and DELTA-1 into a fully integrated tape and disk storage system.

North Star owners may take advantage of the availability of the MFM Disk Controller card to double disk storage space from 90K bytes to 180K. The price for the controller card alone is $199.

Available software includes CP/M disk operating system with editor, assembler, debugger and BASIC-E, for $98. Microsoft Extended Disk BASIC is offered for $195. Several applications programs are available which operate with both the DELTA-1 and the ALPHA-1.

A special introductory price of $699 includes the mini-floppy single-sided disk drive, MFM Disk Controller, power supply, connectors and cable, complete documentation, and MECA disk operating system.

For full details, contact MECA, 7026 O.W.S. Road, Yucca Valley, CA 92284. Telephone: (714) 365-7686.

CIRCLE 187 ON READER SERVICE CARD

NEW H8 FLOPPY DISK KIT FROM HEATH

Having first introduced the fully-assembled and tested version of its H8 Floppy Disk System, the WH17, Heath Company, Benton Harbor, Michigan now announces the availability of their kit Floppy, the H17.

As you would expect, the H17 kit version is identical in features and specifications to the assembled WH17 Floppy. These include 102K Bytes of available storage area per disk, a fully-assembled WANGCO Model 82 disk drive (expandable to dual disk), the interface/disk controller circuit board kit which plugs directly into the H8 mainframe, and a self-contained power supply. The storage media is the expanded 40-track seek time and a typical random sector access time of less than 250 milli-seconds for the new unit.

The operating system software for the H8/H17 Floppy Disk System is available and designated H8-17. This software includes the Heath Disk Operating System (HDOS) with diagnostic for unit evaluation and optimization; the BUG-8 console debugger; TED-8 text editor; HASL-8 assembly language and extended Benton Harbor Basic. An extra diskette is also included.

For additional information on the H17, the H17-1 (its optional second drive) and the H8-17 operating system software which are mail order priced at $530.00. $295.00 and $100.00 respectively, send for a FREE copy of the latest Heathkit catalog.

Write Heath Company, Dept. 350-680, Benton Harbor, MI 49022.

CIRCLE 188 ON READER SERVICE CARD

DYNABYTE COMPUTERS IMPLEMENT NEW DISK DRIVE CONTROLLER TECHNOLOGY

A new line of microcomputer systems from Dynabyte introduces a disk drive controller that increases the choice of disk storage configurations.

Top of the line is the DB8/2 Computer System, which offers up to 1.2 megabytes of mass storage on two 5-inch drives. It uses 77-track Micropolis disk drives and with Dynabyte's new controller offers double or quad density in single or double sided configurations—up to eight times the capacity of single-sided, single-density 5-inch drives.

To implement the drives, Dynabyte developed its Dual Density Floppy Disk Controller. It is the first disk controller capable of handling a variety of 5-inch and 8-inch drives in dual density on either one or two sides. To permit expansion of the system as the user's needs increase, the controller is capable of handling up to 16 drives.

The product line's self contained disk storage capacity, flexibility and expandability was developed by Dynabyte for business, professional and scientific applications.

Dynabyte's exclusive Dynamic Data Compensation yields a double density error rate comparable to single density rates. Dynabyte is using the module exclusively in its computer systems. The DB8/2 includes a 4MHz Z-80 microprocessor module which contains two RS232 serial I/O ports, one parallel I/O port, an EPROM programmer, two TMS2716 sockets, vectored interrupts and a real time clock.

The unit has 32k of RAM and the Disk Controller in a 12-slot backplane fully populated with mil-spec S-100 connectors. It uses a regulated power supply designed to comply with U.L. approved standards.

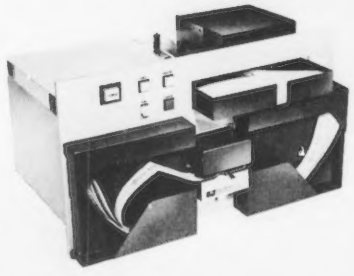
CP-M* Disk Operating System was chosen for the Dynabyte systems because of its wide acceptance and available software. Initial language and software packages from Dynabyte include BASIC, FORTRAN, COBOL, word processing, general ledger and accounts receivable, with more package software to come.

Dynabyte is also introducing the DB8/1, a Z-80 Computer with no mass storage, and the DB8/4 Floppy Disk System with two 8-inch disk drives with up to two megabytes of storage.

A product brochure is available from Dynabyte, Inc., 1005 Elwell Court, Palo Alto, CA 94303. Phone (415) 965-1010.

*CP/M is a trademark of Digital Research.

CIRCLE 189 ON READER SERVICE CARD



NEW READER PUNCH

Digitronic's new Model RP 7100/D, Reader/Punch is a self contained unit combining a latest state-of-the-art 75 CPS paper tape punch with a mechanically simple 300 CPS photoelectric tape reader.

The Model RP 7100/D package contains all necessary DC power supplies and required control and signal interface logic circuitry. The interface logic and signals are also fully compatible with other reader/punch combinations available today and will interface to most minicomputers.

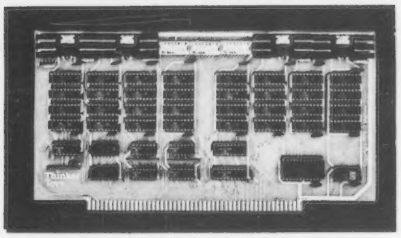
The punch, like all new Digitronics punches, is sprocket fed for more positive tape advance and is designed to give less slippage with mylar tape.

All reader and punch input and output signals are DTL/TTL compatible and are available in either positive or negative logic commands and data outputs. $2395.

For additional information write: Art Soucy, Digitronics Division, Comtec Information Systems, Cumberland, R.I. 02864. Or phone: (401) 724-8500.

CIRCLE 190 ON READER SERVICE CARD

HARDWARE



MORROW INTRODUCES 16K STATIC RAM AT $299 PRICE!

George Morrow, designer of the best-selling ECONORAM™ 4K static memory, has introduced a new 16K static memory board for S-100 microcomputer systems, "SupeRam™ 16".

Retailing for just $299, Morrow's newest cost cutter will save from $50 to $100, compared to prevailing prices in 16K kits.

SupeRam 16 is a complete kit featuring four independently addressable and write-protectable 4K blocks. The super-efficient design uses just eleven ICs to keep the board uncrowded and trouble-free. The board was designed to meet the proposed IEEE Standard for S-100, insuring full compatibility with all S-100 systems. All signals are fully buffered, including address and data lines. $299.

SupeRam 16K is available at computer retail outlets throughout the U.S. It may also be ordered directly from Thinker Toys, 1201 - 10th St., Berkeley, CA 94710.

CIRCLE 191 ON READER SERVICE CARD

CALL ME TUESDAY AT FOUR

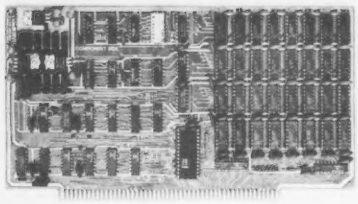
A unique combination of crystal derived Real Time Clock, hardware interrupts, and PROM software come together in the TIMEMINDER — an S-100 compatible board by Objective Design, Inc., P.O. Box 20325, Tallahassee, FL 32304. TIMEMINDER software will maintain a list of user requested wakeup calls and alert the indicated routines at appointed times. Intervals range from milliseconds to days. User calls can also be based on the TIMEMINDER time-of-year calendar. Wake-up requests are then given as time and date. Because this is an interrupt driven device, the computer is always available for non-timed activities while waiting for the next alarm. Timed interrupts may also be applied to control of time-critical hardware and software — a valuable tool for scientists and experimenters.

TIMEMINDER software is held in on-board PROM, with scratchpad RAM also available on the card. The interrupts and the required 'CALL' instruction vectors are all generated on-board. Additional interrupts are free for general system use.

In kit form, the TIMEMINDER, which includes one PROM is $224.95 with shipping charges of $5.00 Canada and $20.00 for other foreign countries.

For further information, contact Objective Design, Inc., P.O. Box 20325, Tallahassee, Fl. 32304, (904) 224-5545.

CIRCLE 192 ON READER SERVICE CARD



IMSAI INTRODUCES NEW DYNAMIC RAM

RAM III, a new line of dynamic random access memory boards developed by IMSAI Manufacturing Corporation, is available in 32K byte or 64K byte versions. The 32K version retails at $895 and the 64K version retails at $1695. RAM III boards are S-100 bus compatible and do not obsolete already existing IMSAI RAM boards.

When selecting a dynamic random access memory board, a major consideration is reliable data retention. With RAM III, refresh occurs during all stages of computer operation. During a normal Central Processing Unit (CPU) operation, the refresh synchronizes to CPU timing so that refresh takes place when the CPU is not using memory. This "Hidden Refresh" means *no wait states* are required. During operations that take place when the CPU is not running, such as Direct Memory Access (DMA), an internal timer generates refresh requests every 6.6 microseconds.

A high-precision delay line generates on-board timing for high performance and reliability. All of the RAM III boards have an access time of 375 nanoseconds and a cycle time of 500 nanoseconds.

Another plus for IMSAI RAM III is the exceptionally low power requirements of +8 volts DC at 360 milliamperes, +16 volts DC at 250 milliamperes and -16 volts DC at 10 milliamperes. The total board dissipates a mere seven watts.

IMSAI RAM III boards are designed to be reliable and easy to maintain. For example, latched critical signals eliminate noise susceptibility. The RAM chips and the refresh controller *are socketed for ease of repair.* Important signals are available at test points to simplify the use of test equipment with the boards. In addition, RAM III boards are burned-in at the factory and put through extensive tests under strict quality control.

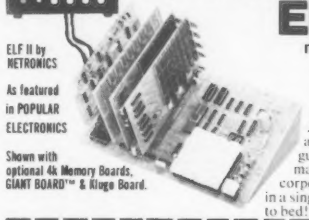
For further information — contact Walter Slater: IMSAI Manufacturing Corporation, 14860 Wicks Boulevard, San Leandro, California 94577 (415) 483-2093.

CIRCLE 193 ON READER SERVICE CARD

HOBBYISTS! ENGINEERS! TECHNICIANS! STUDENTS!

Write and run machine language programs at home, display video graphics on your TV set and design microprocessor circuits—the very first night—even if you've never used a computer before!

ELF II featuring **RCA COSMAC** microprocessor / mini-**COMPUTER** $99.95



Stop reading about computers and get your hands on one! With a $99.95 ELF II and our *Short Course* by Tom Pittman, you master computers in no time at all! ELF II demonstrates all 91 commands an RCA 1802 can execute and the *Short Course* quickly teaches you to use each of the 1802's capabilities. ELF II also displays graphics on any TV set, including an exciting new target/missile gun game! Add-ons are among the most advanced available anywhere. You get massive computing potential. No wonder IEEE chapters, universities and major corporations all use ELF II to train engineers and students! Kit is easily assembled in a single evening and you may still have time to run your first programs before going to bed!

SEND TODAY!

NOW AVAILABLE FOR ELF II—

☐ Tom Pittman's ***Short Course On Microprocessor & Computer Programming*** teaches you just about everything there is to know about ELF II or any RCA 1802 computer. Written in non-technical language, it's a learning breakthrough for engineers and laymen alike. **$5.00** postpaid!

☐ Deluxe metal **cabinet** with plexiglas dust cover for ELF II. **$29.95** plus $2.50 p&h.

☐ ELF II connects to the video input of your TV set. If you prefer to use your antenna terminals, order **RF Modulator, $8.95** postpaid.

☐ **GIANT BOARD**™ kit with cassette I/O, RS 232-C/TTY I/O, 8-bit P I/O, decoders for 14 separate I/O instructions and a system monitor/editor. **$39.95** plus $2 p&h.

☐ **Kluge** (Prototype) **Board** accepts up to 36 IC's. **$17.00** plus $1 p&h.

☐ **4k Static RAM** kit. Addressable to any 4k page to 64k. **$89.95** plus $3 p&h.

☐ Gold plated **86-pin connectors** (one required for each plug-in board). **$5.70** postpaid.

☐ Professional **ASCII Keyboard** kit with 128 ASCII upper/lower case set, 96 printable characters, onboard regulator, parity, logic selection and choice of 4 handshaking signals to mate with almost any computer. **$64.95** plus $2 p&h.

☐ Deluxe metal **cabinet** for ASCII Keyboard. **$19.95** plus $2.50 p&h.

☐ ELF II **Tiny BASIC** on cassette tape. Commands include SAVE, LOAD, =, +, -, *, /, ( ), 26 variables A-Z, LET, IF/THEN, INPUT, PRINT, GO TO, GO SUB, RETURN, END, REM, CLEAR, LIST, RUN, PLOT, PEEK, POKE. Comes fully documented and includes alphanumeric generator required to display alphanumeric characters directly on your TV screen without additional hardware. Also plays tick-tack-toe plus a drawing game that uses ELF II's hex keyboard as a joystick. 4k memory required. **$14.95** postpaid.

☐ Tom Pittman's **Short Course on Tiny BASIC** for ELF II, **$5** postpaid.

☐ **Expansion Power Supply** (required when adding 4k RAM). **$34.95** plus $2 p&h.

☐ **ELF-BUG**™ **Deluxe System Monitor** on cassette tape. Allows displaying the contents of all registers on your TV at any point in your program. Also displays 24 bytes of memory with full addresses, blinking cursor and auto scrolling. A must for the serious programmer! **$14.95** postpaid.

Coming Soon: A-D, D-A Converter, Light Pen, Controller Board, Color Graphics & Music System...*and more!*

Call or write for wired prices!

Netronics R&D Ltd., Dept. CC9
333 Litchfield Road, Phone
New Milford, CT 06776 (203) 354-9375

Yes! I want to run programs at home and have enclosed: ☐ **$99.95** plus $3 postage & handling for **RCA COSMAC ELF II kit.** ☐ $4.95 for power supply (required). ☐ $5 for RCA 1802 User's Manual. ☐ $5 for *Short Course on Microprocessor & Computer Programming.*

☐ **I want mine wired and tested with power supply, RCA 1802 User's Manual and *Short Course* included for just $149.95 plus $3 p&h!**

☐ I am also enclosing payment (including postage & handling) for the items checked at the left.

Total Enclosed (Conn. res. add tax) $ ☐ Check here if you are enclosing Money Order or Cashier's Check to expedite shipment.

USE YOUR ☐ VISA ☐ Master Charge (Interbank #)

Account #

Signature Exp. Date

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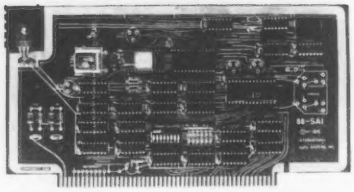
DEALER INQUIRIES INVITED

CIRCLE 160 ON READER SERVICE CARD



SYNCHRONOUS INTERFACE MODULE

International Data Systems, Inc. announces the 88-SAI Synchronous/Asynchronous Interface for S-100 Bus computers. The 88-SAI provides a synchronous or asynchronous port for any S-100 bus processor. The 88-SAI is intended for use in special communications requirements such as synchronous communications between S-100 computers and large scale computers, high speed MODEMs, data encryption devices or other S-100 computers.

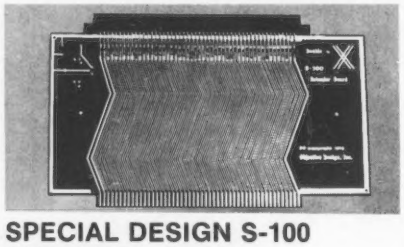
The 88-SAI allows baud rate, word size, parity and number of stop bits to be selected completely under software control. Also under software control is synchronous/asynchronous mode selection and functions associated with synchronous communications such as number of Sync characters.

The 88-SAI is fully compatible with RS232C interfaces. Additional provisions are made on the 88-SAI for interface to non-standard devices requiring that various signal or handshake lines be inverted. The 88-SAI also provides interface to MIL-STD-188 level devices. In order to allow maximum flexibility, provision for use of non-mandatory control signals such as Signal Quality is included.

The 88-SAI is available in kit form for $199.00 or assembled, tested, and with a limited warranty for $299.00. Delivery is from stock.

International Data Systems, Inc., 400 North Washington Street, Suite 200, Falls Church, VA 22046. Telephone (703) 536-7373.

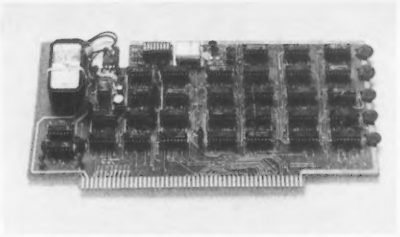
CIRCLE 194 ON READER SERVICE CARD



SPECIAL DESIGN S-100 EXTENDER CARD

A S-100 Extender Card designed to eliminate signal crosstalk and noise pick-up is now available from Objective Design, Inc., P.O. Box 20325, Tallahassee, FL 32304. Called the Double-X Extender, the board uses a special pattern which runs ground lines between signal lines on both sides of the board. Cost of the board is $34.95 in kit form and $44.95 assembled plus shipping of $3.00 U.S. and $15.00 overseas.

CIRCLE 195 ON READER SERVICE CARD



BATTERY BACK UP AND CRYSTAL CONTROL ON NEW CLOCK BOARD

Expand your time-keeping capabilities with Mountain Hardware's new 100,000 Day Clock for S-100 computers.

Several unique features make this Clock an almost indispensable addition to your system. The Clock is crystal controlled for accuracy and an on-board, 9 volt rechargeable battery keeps your Clock ticking away during computer down times, intentional and otherwise!

This versatile board keeps time in 100us increments for periods as long as 100,000 days, that's 273 years! An interrupt feature has been provided which can be programmed for any change in a Clock digit to help make efficient use of computer time.

It is extremely easy to set the Clock by entering BCD digits at each time port. The Clock stops the moment you enter the first digit and starts again on the first "read" command. A "write protect" switch prevents the Clock from being accidentally stopped or changed.

For further ease, the Clock can be used with most BASICs. However, our Introl BASIC gives you a powerful set of commands which makes it especially simple to set, compare, check, display and print time.

Price of the 100,000 Day Clock is $219 assembled and tested, $179 in kit form. Delivery is stock to 30 days.

For more information, please address Mountain Hardware, Inc., 5523A Scotts Valley Drive, Scotts Valley, CA 95066. Phone: (408) 438-4734.

CIRCLE 196 ON READER SERVICE CARD

SOFTWARE

TRS-80 LEVEL II SOFTWARE

The LIBRARY 100, from The Bottom Shelf, Inc. is a collection of 100 quality programs for the Radio Shack TRS-80 Level II computer. With 30 games, 25 business & finance, 15 education, 15 home, and 15 graphics, the LIBRARY 100 is a bargain at the price of $49.50 + $2.00 p&h. The programming is totally new and some of the graphics games look like they belong in an arcade. With five cassettes bound in an attractive folder together with instructional documentation, the LIBRARY 100 is indeed a basic library for any Level II TRS-80 owner!

Contact: The Bottom Shelf, Inc., P.O. Box 49104, Atlanta, Georgia 30359 - (404) 939-6031

CIRCLE 197 ON READER SERVICE CARD

CROMEMCO COBOL

COBOL, which is one of the most common languages for use in business system programming, is now available for Cromemco's Z-80 based microcomputer systems. Cromemco COBOL is based on American National Standard X3.23-1974, so users have access to the large number of programs already written in COBOL.

Cromemco COBOL includes all ANSI Level 1 features for the Nucleus and for Sequential, Relative, and Indexed file handling; Table handling; Library; and Inter-program Communication facilities. Cromemco COBOL also includes the most useful Level 2 options such as the verbs STRING, UNSTRING, COMPUTE, SEARCH and PERFORM; abbreviated and compound conditions; and condition names.

Cromemco COBOL supports a data format which permits compact storage of decimal data on diskette. This data format allows numerical data to be packed two digits to the byte so that mass storage requirements are reduced.

A batch style DEBUG technique, designed to get programs running in a minimum of on-line time, is also included.

Cromemco COBOL is available on 5" (Model FDC-S) or 8" (Model FDC-L) IBM-format, floppy diskettes for $95.

For additional information contact Cromemco, Inc., 280 Bernardo Avenue, Mountain View, CA 94043; (415) 964-7400.

CIRCLE 198 ON READER SERVICE CARD

MAILING LIST

MAILING LIST is a general purpose mailing label program which enables the user to start and maintain a mailing list. Operations include: Add, Delete, Search, Sorted List, Modify, And Sequential Printout. The user is given the option of having a Remark Field up to 64 characters long for any additional information which can then be used to sort or retrieve information by. The user can also set up and change default printing formats controlling the exact placement of up to five labels across a page, whether or not to print the Remarks field, and the placement of the zip code. The program is designed to be easily used without any prior knowledge of computers.

Written in Disk BASIC for a PolyMorphic Systems 8810 or 8813, the complete program comes on diskette or as a hard copy list for $40. Order from: Software Industries, 902 Pinecrest, Richardson, TX 75080.

CIRCLE 199 ON READER SERVICE CARD

THE MICROCOMPUTER SOFTWARE STANDARD

CP/M™ OPERATING SYSTEM

- Editor, Assembler, Debugger, and Utilities
- For 8080 and Z-80 Systems
- Up to four IBM-compatible floppy disks
- Documentation includes:
  - **CP/M Features and Facilities**
  - **CP/M Editor Manual**
  - **CP/M Assembler Manual**
  - **CP/M Debugger Manual**
  - **CP/M Interface Guide**
  - **CP/M Alteration Guide**

MAC™ MACRO ASSEMBLER

- Compatible with new Intel Macro standard
- Complete guide to Macro Applications

SID™ SYMBOLIC INSTRUCTION DEBUGGER

- Symbolic memory reference
- Built-in assembler/disassembler

TEX™ TEXT FORMATTER

- Powerful text formatting capabilities
- Text prepared using CP/M™ Editor

DIGITAL RESEARCH

Please send me the following:

- ☐ **CP/M™ System Diskette** and **Documentation** (Set of 6 manuals for **$100.**
- ☐ **CP/M™ Documentation** (Set of 6 manuals) only for **$25.**
- ☐ **MAC™ Diskette** and **Manual** for **$90.**
- ☐ **SID™ Diskette** and **Manual** for **$75.**
- ☐ **TEX™ Diskette** and **Manual** for **$75.**
- ☐ Send information on CP/M User's Group, high level languages and optional packages.

DIGITAL RESEARCH

NOTE: Due to the proprietary nature of CP/M™ software, please enclose your CP/M Serial No. when ordering MAC, SID, or TEX without the CP/M diskette. CP/M™ Serial No. _____

☐ BankAmericard No. _____ Exp. Date _____

☐ Master Charge No. _____ Exp. Date _____

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CIRCLE 130 ON READER SERVICE CARD

PERSONAL LEDGER FOR COMMODORE PET™*

Channel Data Systems introduces Personal Ledger, a complete double entry bookkeeping system with provisions for budgeting and keeping records of income, deductible and non-deductible expenses, assets and liabilities. Its simple interactive features enable entering transactions, adding or editing accounts and printing of a detailed Income Statement and Balance Sheet. Users completely unfamiliar with computerized accounting and with little or no knowledge of bookkeeping can use the system.

Up to 50 accounts are allowed with names and budgets specified by the user. An audit trail of all entered transactions is printed on the printer of your choice or on the screen if you do not have a printer. All data is stored on cassette, loaded prior to entering transactions and stored after entering. There is no waiting for printing to the tape during operation of the system. Extensive error recovery features are included to allow reentry of an erroneous instruction or value.

Personal Ledger is supplied on cassette, along with a complete manual, program listing and sample data for only $20.00.

Channel Data Systems, 5960 Mandarin Avenue, Goleta, CA 93017, or telephone (805) 964-6695.

*8k Bytes RAM Required

CIRCLE 200 ON READER SERVICE CARD

TRS-80 ELECTRIC PENCIL WORD PROCESSING PACKAGE

SMALL SYSTEM SOFTWARE and MICHAEL SHRAYER SOFTWARE are proud to announce the release of THE ELECTRIC PENCIL word processor for the TRS-80 computer. THE ELECTRIC PENCIL is offered both as a separate software product and as part of a complete word processing package which includes our TRS232 serial printer interface and a modification kit which provides lower case entry and display as well as a separate control key. THE ELECTRIC PENCIL, highly respected as one of the finest word processors available for home computers and small businesses, is a quality software product that opens many new uses for the TRS-80 computer.

In addition to the standard ELECTRIC PENCIL features (free format entry, line and character insertion, line and character deletion, forward and reverse scrolling with speed control, string search, coded string search, string search and replace, block moves, inserts, and deletions, fully formatted print control, page titling, page numbering, etc., etc.), the TRS-80 version offers the following additional features:

1) Loads into either LEVEL-I or LEVEL-II 16K computers from the same tape. Load rate is 500 baud.

2) Operates upper-case only in unmodified machines, or operates with upper and lower case after installation of our modification kit.

3) Displays a transparent cursor. The character and the cursor are both visible simultaneously so you can see the character you are editing.

4) Runs either the Radio Shack standard printer through their expansion box or will operate any RS-232 300 baud printer using our TRS232 printer interface.

5) Includes special keyboard software with both 2-key rollover and repeat function (any key will repeat at 10 characters per second after a 0.5 second delay).

THE ELECTRIC PENCIL is priced at $99.95. The TRS232 printer interface is $39.95. Deliveries will begin September 10, 1978. Instructions for the lower case modification are included in the documentation. A kit of parts will be available at a later date.

Small System Software, Post Office Box 483, Newbury Park, CA 91320

CIRCLE 201 ON READER SERVICE CARD

SOFTWARE PACKAGED IN NORTH STAR FORMAT

The following Applications Software on mini-diskette is packaged in North Star format. Made available through MicroAge, each of these discs is ready to run in any S-100 8080/Z80 computer system. Here's the current offering:

- Financial Programs from "Some Common Basic Programs" by Osborne & Assoc.
- Mathematical Analysis Programs from "Some Common Basic Programs"
- Statistical Programs and Miscellaneous Programs from "Some Common Basic Programs"
- Games, Volume 1 includes: Trap, Batnum, Hukle, Taxman, Stars, Reverse, Mathdrill I, Cannon, Chomp, Weekday, Calendar, Pony.
- Games, Volume 2 includes: Button, Frog, String, Change, Civilwar, Golf, Golfhand, Chase!, Shooting Star, Lunar Lander, Mathdrill II.
- Backorder Program using disc data files
- Mailing List using disc data files
- Just released! Northstar DOS for your Centronics printer. Retail Sales Reporting using disc files. Customer reads Profile using disc files.

Price: $35 each. Available from MicroAge Mail Order, 803 N. Scottsdale Rd. Tempe, AZ 85281

CIRCLE 202 ON READER SERVICE CARD

SOFTWARE REFERRAL PROGRAM LEADS OFF WITH C/PM DOS

CANOGA PARK, Calif., June 5, 1978-A program to stimulate the exchange of system and applications software between its customers has been launched by Micropolis Corporation, manufacturers of the highest capacity 5¼-inch floppy disk drives in the industry.

The company is distributing the first edition of a newsletter this month, which will be the principal forum for providing information on user-developed software packages. The initial newsletter describes CP/M™* disk operating systems available from three vendors, according to Robert T. Chisum, Micropolis marketing manager. The new DOS packages, developed for standard S-100 software buses, provide the user with flexibility in applications programs and language selection, such as FORTRAN and BASIC.

"CP/M has become the most widely used S-100 floppy disk operating system," Chisum said, "with features such as dynamic allocation of diskette storage; relocatability of system in memory; intrinsic commands to save, rename, erase and display directories of files; and complementary context editor, assembler and dynamic debugging program."

Programmers that have developed software on a Micropolis floppy disk should write the company for a copy of its referral questionnaire or obtain a copy of the first newsletter in which the form is reproduced.

Micropolis manufacturers a wide range of personal and occupational computing floppy disk subsystems in single, dual and quad drive configurations, with extended storage capacities of up to 1.2 million bytes per subsystem.

Contact: Jim Molenda, Micropolis Corporation, 7959 Deering Avenue, Canoga Park, Calif. 91304; Telephone: (213) 703-1211.

*CP/M is a registered trademark of Digital Research Corporation.

CIRCLE 203 ON READER SERVICE CARD

8080 TAUGHT TO SPEAK ENGLISH

ANGLOPHONE is an 8080 program which converts ordinary English in real time into phonetic codes to drive popular brands of speech synthesizers. Just as assemblers and compilers eliminated the need for tedious machine-language programming, ANGLOPHONE eliminates the need for hand-coding of phonetic messages for speech synthesizers. Large data bases which would take years to hand code into phonetic notation are now instantly available for speech output. For instance, an inexpensive 8080-based telephone interface could allow sales and service personnel or customers to query an inventory system from any touch-tone telephone.

Hardware needed is an 8080 CPU, 8K bytes of memory and a speech synthesizer. ANGLOPHONE can be patched easily into any higher level programming language. Talking terminal software is available to convert an 8080-based intelligent terminal into a talking terminal for use on any computer system.

The price of $100 includes source and object code on paper tape or cassette and a 120 page user's manual.

For further information, contact UPPER CASE books, 502 E. John St., Champaign, Illinois 61820; (217) 384-4382.

CIRCLE 204 ON READER SERVICE CARD

TRS-80 CUSTOM SOFTWARE

YOU NAME IT, WE'LL WRITE IT!!
No mass production. You get individual attention!! We have some pre-written programs available. Also, lots of information on Computer Crime. For more details send 25¢ or S.A.S.E. to:
COMPUTER CONSULTANTS
312 Hoyt St., Dunkirk, N.Y. 14048

CIRCLE 145 ON READER SERVICE CARD

Radio Shack's personal computer system? This ad just might make you a believer.

You can't beat the 4K system at $599

TRS-80 "Breakthru"
- TRS-80 microcomputer
- 12" video display
- Professional keyboard
- Power supply
- Cassette tape recorder
- 4K RAM, Level-I BASIC
- 232-page manual
- 2 game cassettes

...or the step-up 16K system at $899

TRS-80 "Sweet 16"
- Above, except includes 16K RAM

...or the fast 4K/printer system at $1198

TRS-80 "Educator"
- Above, except includes 4K RAM and screen printer

...or the Level-II 16K/printer/disk system at $2385

TRS-80 "Professional"
- Above, except includes 16K RAM, disk drive, expansion interface, and Level-II BASIC

So how are you gonna beat the system that does this much for this little? No way!

...The amazing new 32K/Level-II/2-disk/ line printer system at $3874

TRS-80 "Business"
- Above, except includes 32K RAM, line printer, and two disk drives

Get details and order now at Radio Shack stores and dealers in the USA, Canada, UK, Australia, Belgium, Holland, France, Japan.
Write Radio Shack, Division of Tandy Corporation, Dept. C-044, 1400 One Tandy Center, Fort Worth, Texas 76102. Ask for Catalog TRS-80.

Radio Shack®
The biggest name in little computers

MISCELLANEOUS

'FIRST WATCH' LEARNING AIDS FROM TI

First Watch™, a watch and learning aid materials designed to teach children from five to seven years old to learn to read any watch or clock, was recently introduced by Texas Instruments Incorporated.

The First Watch scientific system offers a microelectronic digital watch and two learning aids. The First Watch package includes a specially styled, colorful LED (Light Emitting Diode) watch, a Hands of Time ™ learning dial and a "fun games and how-to" book—all structured to help youngsters learn both analog and digital timekeeping—and enjoy doing it.

"Ditital time is here to stay," a TI spokesman commented, "but today's youngsters still need to know how to read conventional "'bit hand-little' hand time."

The Hands of Time dial, which can be used as an independent learning or games-playing instrument, enables children to dial any time of day and see it expressed both in numbers and with hands. The dial is also used to play some of the games.

The illustrated, four-color "How to Tell Time Both Ways" book relates the fascinating history of timekeeping—from cave man to space age—and offers learning games selected for their educational value as well as for the fun they can provide younger children who are learning to tell time. Interesting facts on man and how he relies on the measurement of time relate, for example, how U.S. railroads established AM and PM time and divided the country into time zones. Games include analog concepts of quarter and half hours and AM/PM.

TI's First Watch, with a suggested retail price of $19.95, is scheduled for consumer availability in June and will have a one-year limited warranty. Batteries are included with the watch.

Texas Instruments Incorporated, Consumer Relations, P.O. Box 53 (Attn: LED Watches) Lubbock, TX 79408

CIRCLE 205 ON READER SERVICE CARD

TIS

Documentation and software applications packages for the COMMODORE PET 2001. Workbooks from $3.95; software from $4.95.

For a flyer describing all our products, please send a self-addressed stamped envelope to TIS, P.O. Box 921. Los Alamos, NM 87544.

CIRCLE 147 ON READER SERVICE CARD

CALCULATORS

NEW LOW-COST SLIMLINE CALCULATOR FROM TI

Slimline TI-1030™ offers an easy-to-read LCD (Liquid Crystal Display) readout and six standard functions (add, subtract, multiply, divide, percent, square root). Packaged in a handsome brown plastic case with brushed metal overlay, the light, thin unit measures approximately 4.5 inches by 2.6 inches by 0.3 inches and weighs less than 2.5 ounces.

The TI-1030 is scheduled for availability in July 1978. $15.95

For additional information: Texas Instruments Incorporated, Consumer Relations, P.O. Box 53 (Attn: TI-1030), Lubbock, TX 79408

CIRCLE 206 ON READER SERVICE CARD

TEXAS INSTRUMENT'S NEW PRINTER/DISPLAY CALCULATOR

A rechargeable handheld printer/display calculator was introduced by Texas Instruments Incorporated at the Summer Consumer Electronics Show (CES), June 11-14.

Features and functions of TI-5025 are ideally suited to general consumer use, a company spokesman pointed out. "It is one of the smallest and—at a suggested retail price of $80—one of the least expensive portable printer/display calculators on the market," he said.

TI-5025 features a thermal printer and a large vacuum fluorescent display that can be used without the printer to conserve paper. The unit provides four basic functions as well as percent and four-key memory.

Of special importance to general users, the TI spokesman observed, is that TI-5025 operates with the same, simple number entry system used in other TI handheld calculators. "There's no other entry sequence to learn as with large printer/display machines," he said.

TI-5025's thermal printer has considerably fewer parts than impact printers and thus provides reliable, whisper quiet, ribbonless operation. Thermal paper rolls will be available in "three-packs" carrying a $.99 suggested retail price.

The unit is 6.7 inches long by 3.4 inches wide by 1.8 inches high, and comes with a charger/adapter, thermal paper and carrying case. Initial deliveries are scheduled for August.

For further information, contact: Texas Instruments Incorporated, Consumer Relations, P.O. Box 53 (Attn: TI-5025), Lubbock, TX 79408.

CIRCLE 207 ON READER SERVICE CARD

TRS-80 COMPUTING

non-profit newsletter

$10 (U.S.)/12 issues payable

Computer Information Exch., Inc.
Box 158
San Luis Rey, CA 92068

CIRCLE 138 ON FREE INFORMATION CARD

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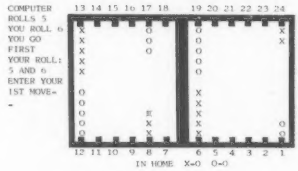
>>>FASTGAMMON>>>®

An Exciting New Backgammon Opponent!



Available for

- **TRS-80** (level II, 16K)
- **COMPAL-80**
- **APPLE II** (16K)
- **SOL** } available soon
- **PET** }

OUTSTANDING FEATURES!—Computer makes good moves instantaneously. Literal and graphic displays of each move. Option to replay same rolls. Eight-page instruction manual.

ORDER NOW!—Specify cassette ($20.) or disk ($25.) California residents add 6% sales tax.

Quality Software
10051 Odessa Avenue
Sepulveda, CA. 91343

CIRCLE 135 ON READER SERVICE CARD

The New MSI SYSTEM 12 Business Computer

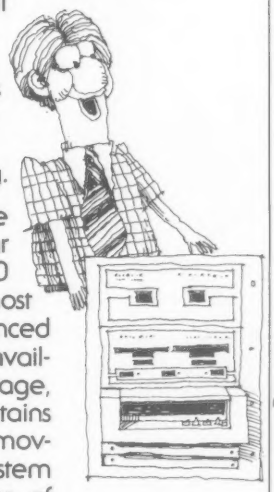
A Profitable System

The MSI System 12 is a low-cost business computer system designed to help your small business the same way big computers help big business . . . by saving time and money.

Regardless of the size or type of your business . . . the System 12 will help you significantly reduce costs by increasing the speed, accuracy, and efficiency of your business operations.

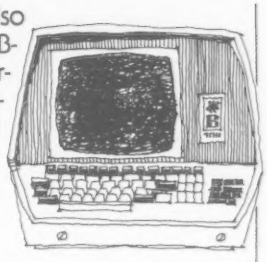
The System for Every Application

The System 12 will fulfill the data processing needs of any type of business . . . service . . . manufacturing . . . professional . . . or marketing.



At the heart of the system is the popular 48K RAM MSI 6800 processor . . . the most powerful and advanced 6800 computer available. For mass storage, the System 12 contains the MSI Fixed/Removable Hard Disk System with 10 megabytes of memory. The new SDOS Operating System integrates the hard disk with the MSI Quad Floppy Disk System which gives you an additional 1.2 megabytes of memory for program loading, back-up, software updates and exchanges.

The System 12 also employs a Beehive B-100 video display terminal and a Centronics 779 high speed printer. The entire system is housed in a single compact desk unit.



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MSI is a leader in the development of small computer systems for business. The new System 12 has the power and capacity to perform as well as many of the other larger computer systems . . . but at a much lower cost.

If your business is in need of a new or advanced data processing system, call or write for detailed literature and the name of the System 12 representative nearest you.

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Random Ramblings

With David Ahl

TV Show Filmed at Creative Computing

On Monday, August 21, 1978 our Morristown building was overrun by an 8-person TV crew complete with cameras, lights, microphones, recorders, and the works. I wish I had shot a couple of photos to show you what it was like. Six hot hours later, the crew from "Fast Forward" thought they had what they needed for their show on microcomputers.

"Fast Forward" is a weekly half-hour show on Ontario Educational TV dealing with high technology such as VTR, micros, lasers, etc. and their impact on society.

In the show taped at Creative I tried to give viewers a crash course in consumer electronics starting with pocket calculators, some Mattel and Coleco "smart" electronic games, Atari video pinball, and the Bally Arcade. I went through a simple programming tutorial on the Bally with some random music and color graphics. The crew then shoehorned themselves into our already cramped computer lab and got some shots of people using the Apple, Pet, Xitan and others of our assorted fourteen systems.

Later in the week, the crew moved on to PC'78 in Philadelphia and taped a portion of the Computer Music Festival held there. The festival was held in one of the smaller ballrooms of the Sheraton and it was absolutely packed. Attendees heard a fantastic 2½ hour concert of music played on the RCA Cosmac, Solid State Music, ALF, Newtech and homebrew synthesizers. Hal Chamberlain "played" an amazing rendition of Bach's Tocatta and Fugue in d minor which took over three hours to "complete" but only 8 minutes to play.

When the concert let out, many attendees made their way to the 15th floor to Creative's annual wine and cheese receiption. Words can't begin to describe that affair so I won't even try.

Creative Computing Software Development Center

As many of you gentle readers know, **Creative Computing** is more than a magazine alone. We are a book publisher, book service, consultant, and software producer. Broadening out from our initial announcement of software for three computers, we are now working on packages for seven computers (indicated with a † in the list below). In addition, to bring you objective software and peripheral reviews, we generally like to test the item in question in our own facility. Thus we currently have in our software center no less than 15 computer systems, 5 terminals, 3 video game systems, and an amazing variety of peripherals and boards. In addition we have access to 5 timesharing systems not to say anything of an immense collection of electronic games.

One corner of Creative's Software Development Center. Here a programmer is instructing the PET what to do. Visible in the background is the TTY 43, DEC VT05, Xitan and Icom dual floppy.

Jeff Yuan works on the Apple in this corner of Creative's SDC. Also visible: one TRS-80, SWTPC 6800 and TTY 33. ⟶

Here's a list of the major items in our incredibly cramped Software Development Center (hopefully by the time you read this our SDC will occupy a second building that we are negotiating to purchase).

Computer Systems

†Processor Technology SOL-20
†Commodore PET
†Radio Shack TRS-80 Level I
†Radio Shack TRS-80 Level II
†Apple II
†Ohio Scientific Challenger 1P
†Exidy Sorcerer
Bally Arcade
MITS Altair 8800
Xitan (with Icom dual floppy)
MSI 6800 (with dual floppy)
Southwest Technical 6800
IMSAI 8080
Heathkit H-8
Heathkit H-11

Video Game Systems

Atari Video Computer System
Coleco Telstar Arcade
Atari Video Pinball

Terminals and Printers

Texas Instruments 810
DEC VTO5
Teletype KSR-43
Teletype ASR-33
Heathkit H9 (2)

Send Us Your Software

We are seeking top quality software from readers for marketing by **Creative Computing.** We pay a 10% royalty of the $7.95 list price of the tape. (Naturally if your program is one of five of a tape, you get 1/5 of 10%, or 2%). We pay an advance at the time of acceptance on the first 100 sales ($79.50). Send us a cassette with program recorded twice, complete documentation and 3 stamps for return.

Chess from Commodore

We heard from a reliable source that Commodore (of Kim, PET and electronic watch fame) is planning to make an electronic chess game called Chessmate. It is based on the 6504 chip and is physically similar to a desk calculator with LED display. One nice touch is that it has a speaker which plays a cute melody if it wins, plays a downward sliding scale if it loses, and also tells you when it's made its move.

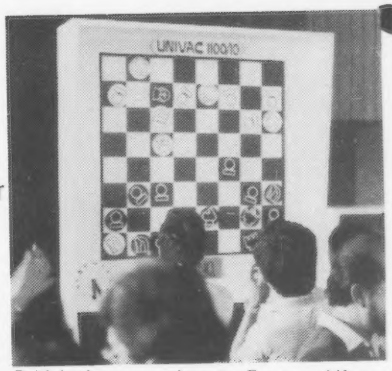
searcc 78 South East Asia Regional Computer Conference

Manila, Philippines

For the last seven or eight years, I've been giving presentations on educational computer applications, simulations, games, music, etc. to a variety of audiences. Apparently they've been well received because I've been asked to do some educational TV shows and my conference invitations have increased in number and broadened in scope. One delightful invitation was to speak on microcomputer applications at the **1978 Southeast Asia Regional Computer Conference** in Manila September 4-8, 1978.

The SEARCC area covers Australia, New Zealand, Japan, Korea, India, Thailand, Indonesia, Malaysia, Singapore, Hong Kong and, of course the Philippines. Since it is principally a confederation of developing nations, the latter five tend to be the most active. The conference theme was "Harnessing Computer Technology for National Development" under which banner virtually any paper was admissable. The quality of the papers was surprisingly high, particularly considering that most came from members of developing nations (both Australia and Japan have their own national computer conferences, so few papers were received from either nation). One unfortunate exception was a presentation on "Trends in Computer Technology" by William Conlin, a vice president of Burroughs, which turned out to be a poorly-disguised commercial for his company.

Melecio Magno, Philippines Minister of Science and Development emphasized that peoples' fear of computers taking over probably stems from a lack of self-confidence in controlling an "alien" device.



British chess grandmaster Raymond Keene defeated Univac 1101 "Black Knight" in 34 moves before a huge crowd in the Philippine's first human vs computer exhibition.

In the U.S. the computer industry tends to be male dominated and conference attendance at NCC, etc. tends to be 95% male although certainly more woman are entering the field today. Therefore at SEARCC, I was surprised to see around a 60/40 male/female split in conference attendees. Paper presentors were still predominatly male, but I wouldn't be surprised to see a strong female showing in Jakarta (the next SEARCC site) in 1980.

The U.S. Embassy in Manila sponsored a reception for U.S. manufacturers and SEARCC officials. First Secretary Joe Williams, a long-time reader of Creative, described it as the "the leading edge of a trial balloon." ("Trial" ha! — DHA)

Creative Computing initially had a large double booth at the exhibition. Our decor was hampered a bit by the fact that most of our shipment did not arrive until the conference was over. As a result, I shrunk our space a bit. Despite that, I was able to wave the flag for micros and interactive computing among the EDP giants. No other major magazines or publishers were at SEARCC which indicates either that we're ahead of the pack or we don't know what we're doing. (I prefer to think it's the former).

An overflow crowd attended David Ahl's SEARCC presentation on microcomputer applications attesting to the interest in the subject even in developing nations. Here he receives a plaque at the closing banquet.

SEARCC was held during the rainy season and I can reliably report that in Manila rain does fall horizontal to the ground. In between the rain it was staggeringly hot and humid and one can appreciate vividly what our G.I.s went through liberating the Philippines in WWII. One of the most moving experiences I've ever had was seeing 15,000 crosses in the late afternoon sun at the American cementery in Manila.

While in Manila I had the opportunity to renew an old friendship with Brother Benedict of De LaSalle University. Interestingly enough LaSalle has a requirement that all students in engineering and business courses must take a 2-semester course in programming. Brother Ben, therefore, has over 1100 students learning Basic on one overworked DEC Timeshared 8/I. While I was there, a local company dropped off four demo personal computers (two TRS-80s, a SOL-20 and a SWTPC) at the University. Talk about unbelievable enthusiasm! Seeing the reaction of these students convinces me that micros will have more impact on education than all the mainframes and minis in total.

A portion of De LaSalle University's terminal room housing 16 terminals driven by a Timeshared 8/I.

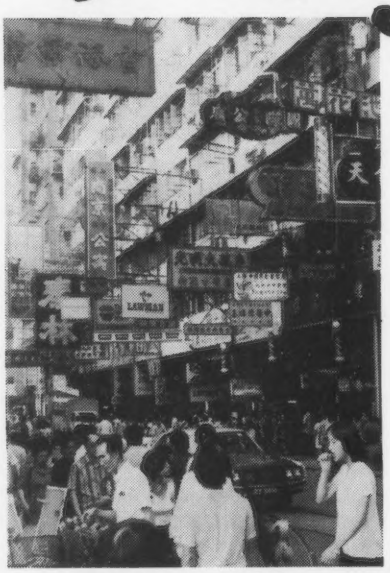
De LaSalle students descended on four micros loaned to the University by IC Systems (Creative's Philippine representative).

Happy Hong Kong

From Manila, I went to Hong Kong Friday, September 8 through Monday September 11. The hustle and bustle of this fantastically industrious little city-state has to be experienced to be believed. The heat and humidity was staggering (95°, 95%) but the industrious Chinese were hard at work virtually round the clock. Shops and family businesses (as most are) are open from 9am to 9pm, seven days a week. Only the government and larger factories close on Sunday.

Although numerous electronic components, video games and the like are manufactured in Hong Kong, personal computers have just started taking a foothold — surprisingly most from the U.S.! I heard of more TRS-80's, than anything else.

Most of the Hong Kong manufacturers do little original design work, or get designs from the U.S. Also, most are quite secretive about what they're doing and even more so about what's coming. Conic Industries almost certainly has something brewing, but wasn't saying what. Radofin, a maker of video games mostly for private label, said they were working on an MPU-based game with a plug-in module for Basic and possibly other languages (like the Bally Arcade). It is targeted for 1979 introduction at the CES and 1980 general availability. Radofin specializes in low-cost versions of popular products (their programmable video computer game system retails for $69) so we can expect bargain-priced computers before long.



Is it possible that some of the most advanced electronics products in the world come out of an environment like this? (Yuk Yat St., Kowloon, Hong Kong).

The three major universities in Hong Kong (HK Univ., Chinese Univ. and HK Polytechnic) operate a joint computer center with a vintage ICL system mostly for research and administration. A number of DEC 11/70 RSTS systems are available for student use but grumbling about DEC support leads me to believe it won't be long before micros start to replace or at least supplement these DEC systems.

Losing It In The Translation

While in Hong Kong I spoke to a journalist about the ease/difficulty of translating computer games and simulations into various oriental languages. His advice: "forget it." to back up his case, he took the movie listings section of one of the Chinese newspapers and told me the Chinese translated titles of the current films showing.

"Smokey and the Bandit" — "Racing cars in unorderly fashion."

"Slapshot" — "The Cursing Roughhouse Rascal Who Plays Dirty."

"Demon Seed" — "Sperm of the devil."

"Jugernaut" — "The great explosion of the Royal Mail Steamer."

"The Guns of Navarone" — "Six strong men."

"The Sailor Who Fell from Grace with the Sea" — "Fright at Midnight."

"What a Way to Go" — "Nice girls get married 18 times."

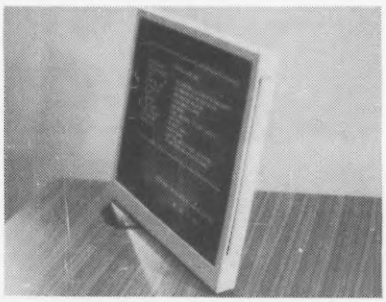
If this is the standard translation of titles, just imagine what the subtitles on the dialog are like! He drove his point home when he told me that in Star Trek, "Condition Red" would probably be translated as "The cacoon in which you live is about to change form to a firecracker."

Japan Journal

Kay Kazuhiko Nishi, publisher of **ASCII,** a Japanese computer hobbyist magazine, acted as my genial host and interpretor during my four days in Japan. **ASCII,** incidentally is **Creative Computing's** agent in Japan. In Japan there are four personal computing magazines: **I/O, RAM, Maicon,** and **ASCII.** In addition there are ten other electronics and professional computer magazines which touch on the field. The personal computing magazines tend to carry articles on how to design and/or build home-brew boards, TV displays and low-level programming reflecting the fact that most Japanese hobbyists are building home-brew or single board systems.

Kay Kazuhiko Nishi, publisher of ASCII Magazine, set up appointments and acted as host, guide, and translator during my four days in Japan.

The Japanese computer industry from micros to minis to mainframes tends to be dominated by five huge vertically-integrated manufacturers who make everything from ICs to household appliances. These companies are Nippon Electric Co. (NEC), Hitachi, Toshiba, Mitsubishi (Melcom), and Fujitsu (Facom). At this point, the big five tend to be following a conservative policy of copying what has been successful for IBM — maybe trying to do it better — but in general avoiding innovation of entirely new products. In foreign markets they tend to be concentrating on peripherals rather than CPUs. Also, what one does, the others tend to follow. At this point in the personal computing field most of the big five along with Matsushita (Panasonic) and Sharp are marketing a single board, no box, no bus, non-extendable computer (see "Bit-INN Shops . . ." in box). One deviant is Hitachi who recently came out with a product called "BASIC Master," a TRS-80 like system. Also Sharp has a PET-like computer planned with an LCD display. On the day I left Tokyo, Fujitsu, perhaps also feeling the need to have a complete system, announced an arrangement whereby they would market the PET in Japan.



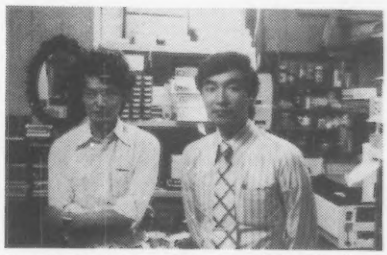
Fujitsu Ltd. (Facom) introduced the 9616 Display Terminal, a 1" thick plasma display terminal which permitted the overlay of a forms transparency on the screen. It is designed mainly for use with their Amdahl systems.

The Cosmos Computer Shop is the first second-hand computer equipment shop in Japan. They sell a large variety of I/O devices along with several personal computers (PET, Apple, etc.) and one manufactured to their own specifications.

Typical Pet Shoppe

On a relative scale, Commodore is marketing the PET much more actively in Japan than in the U.S. This is undoubtedly sparked by the fact that the price (and probably profit margin) is much higher in Japan than the U.S. The PET sells for approximately $1500 in Japan yet over 2,000 have been delivered to date. Commodore actively advertises in the Japanese hobbyist magazines, something which Sid Bernstein (marketing VP of Commodore) in his infinite wisdom has not seen fit to do at home despite a tremendous amount of positive press coverage. In addition, Commodore operates several PET shops in Japan; "PET" standing for "Personal Electronic Things." At the Shinjuku PET Shop, I saw some fabulous PET programs, several of which will be finding their way into the Creative Computing "Sensational Software" library. Nuf said?

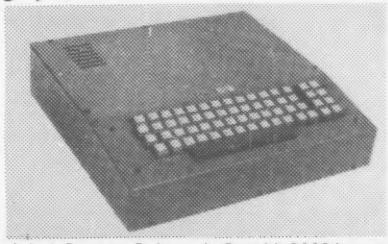
I don't mean to imply that the Big 5 dominate the industry to the exclusion of anyone else. Not so. Even in Japan a cottage industry survives, strives, and thrives. (Talk about alliteration; mein gott!)



President Kamata Isamu and the chief engineer of Adtek System Science Co., a typical "cottage" company, produce and market an impressive line of 14 boards for hobbyists as well as the Comkit 8060 and 8061 computer systems.

One of those cottage industry companies is Adtek System Science. Adtek designed and is marketing one of the first, and certainly lowest priced complete BASIC-speaking, keyboard, boxed system in Japan, the Comkit 8060 and 8061. The assembled 8061 using a Nat'l Semi SC/MP(!) has been on the market since July 1978 and is currently selling a modest 100 units per month. With a 4k ROM for Basic and 8k of RAM, the unit sells for $600 assembled.

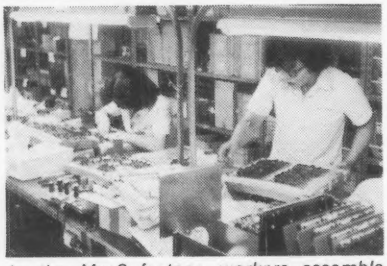
Adtek also offers a wide variety of inexpensive, off-the-shelf boards to hobbyists. They have several nice Video Display boards including one which allows three boards to operate simultaneously to produce complete gray tones.



Adtek System Science's Comkit 8060 is one of the few "complete" systems manufactured in Japan. Price is around $600.

Adtek founder and president, Kamata Isamu was formerly a designer and evaluator in the LSI manufacturing arm of NEC but was bitten by the "own-your-own-business bug." His conservative and profitable marketing strategy does not include plans to go outside Japan.

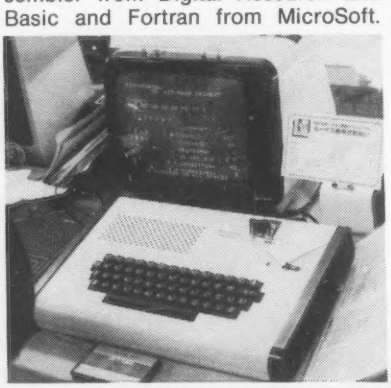
Another successful smaller company is Mac8 (or McEight — they spell it both ways) which was formed in July 1977. Their first product was an Altair-like computer kit called EMIC. The second generation EMIC has an ingenious method of connecting peripherals together side by side. The boxes are narrow (2" to 4") and two connectors in the base connect the bus from one unit to the next.



In the Mac8 factory, workers assemble components for the EMIC computer.

In addition to the EMIC system, Mac8 also produces a high-quality industrial system with 32k and dual floppies called the MACRO/80; price $6500. A third product is their "Intelligent PAL" with CRT, floppy and keyboard built in to a single box. It has amazing graphics resolution (1200 horiz. points!). With 32k, the price is $3000.

Interestingly, Mac8's floppy based systems will use CP/M and Micro Assembler from Digital Research and Basic and Fortran from MicroSoft.



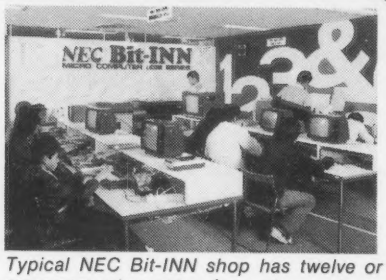
Hitachi H68/TR 6800-based system has full alphanumeric keyboard but only a 16-LED readout. Price is around $400.

Bit-INN Shops Play More Than a Bit Part in the Success of the NEC TK-80

Over a Japanese breakfast of raw fish and egg, various pickled sprouts and vegetables, rice and tea, I talked to Kazuya Watanabe, Manager of Micro Computer Sales and Tomio Goto, Application Engineer of Nippon Electric Co., Ltd. (NEC). NEC got its start in personal computers when Mr. Watanabe took a trip to the USA in the Spring of 1976 and saw several early microcomputers at a trade show. NEC had already been considering some sort of electronic training device, however, he now felt that an mpu should be incorporated in it to enhance the interactive learning aspects. Thus the NEC TK-80 was born in concept in the spring of 1976. Demonstrating phenomenal Japanese dedication and a tribute to Mr. Goto, the main designer, a prototype system was developed by August 1976 and in production two months later.

The original TK-80 (8080A CPU, 1k PROM, 1k RAM, hex keyboard, 8-digit LED) was designed to be a training kit for engineers and students wishing to develop microcomputer applications, however, it found a ready market among hobbyists as well. NEC's claim of sales to date of the bare bones TK-80 is around 20,000 units. The largest U.S. customer is Int'l Correspondence Schools (ICS)

Over a traditional Japanese breakfast, Tomio Goto and Kazuya Watanabe discussed NEC's successful Bit-INN shops and SK-80 computer.



Typical NEC Bit-INN shop has twelve or more computers set up for customers to try out and play with.

who have just contracted to use the TK-80 in their basic microcomputer course. Estimated sales of the follow-on TK-80 Basic Station are 9,000 units thus giving NEC the sales record of microcomputers in Japan. NEC operates three retail demonstration showrooms called Bit-INNs which are well stocked with a wide variety of electronic components for OEM's and hobbyists.

As to future plans, they weren't saying anything except to agree that to expand into other markets it would be necessary to have a self-contained unit with full keyboard, etc. Given NEC's past performance, I'd look for their future product(s) to be winners. Also, given their current success in the U.S. market, it seems likely to expect that their new products will find their way to our shores as well.

Later in the day, I visited a Bit-INN shop in the Akihabara area of Tokyo. (Bit INN is the Japanese equivalent of Byte Shop.) The shop had sixteen systems set up — mostly single-board SK-80's for customers to try out. Talk about letting the product sell itself! There were a couple of sales people to give you a hand, but for the most part you were on your own and could "play" as long as you wished.

Flash: Data General has just agreed to purchase NEC. NEC will now manufacture and distribute DG minis and other products in the far east and DG will market NEC products in the U.S.

Looks like CP/M and the Microsoft languages are on the threshold of becoming a world-wide standard.

One reason the Japanese hobbyists tend to be buying more single-board kits than Basic-speaking systems is because of price. A 4k Level 1 TRS-80 sells for 198,000 yen, about $1050. The Apple II sells for 400,000 yen ($2120) compared to $1195 here. Couple those kind of prices with a somewhat lower wage scale in Japan and you've got to have a dedicated enthusiast indeed who'll plunk down two months salary for a personal computer.

Another drawback to complete systems in Japan is that most Japanese do not know how to type, especially in English. So it's not only an alien language, but an alein device as well. This is a major drawback to using small computers in business which

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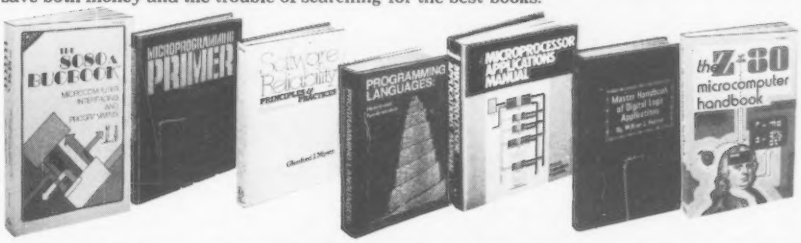

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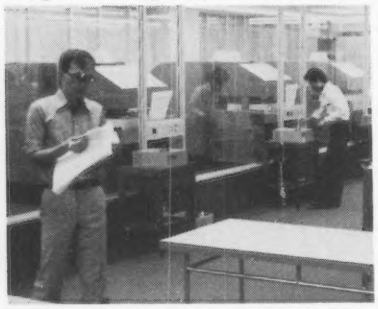
CIRCLE 129 ON READER SERVICE CARD

NEC's TK-80BS is a single board computer with the addition of a keyboard, power supply and TV monitor.

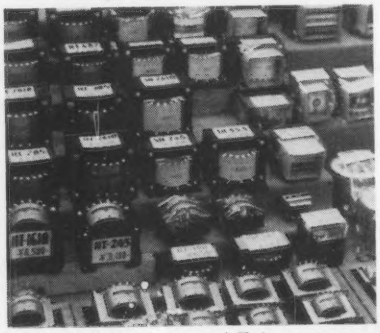
requires the use of both English alphanumerics as well as Chinese characters. A Japanese standard keyboard has been designed incorporating a minimum set of katakana symbols but few versions of Basic are able to handle these symbols much less output the much larger required set of 4000 plus Chinese characters. Two bytes, are necessary to define each character and the smallest dot matrix capable of handling these characters is 10x10. Consequently, personal computers are not likely to expand upward into small business systems in Japan. A considerably more detailed description of the Japanese scene is contained in the paper "Personal Computing in Japan" by Haruhisa Ishida delivered at the USA/Japan Computer Conference in October 1978.

(Incidentally, if you think Japanese people only have trouble pronouncing English words with "r", consider this sentence directly out of Mr. Ishida's paper. "Mr. Ed Yasaki of the Datamation has called Prof. Yasuda one of two gulus in Japan.")



At Tokyo University, the I/O Room has 5 card readers, 9 line printers and a wide assortment of other output devices: plotters, card punches, etc. Students' output is held on massive disk files until requested by insertion of the student's ID card in an output device controller. The University system is the largest in Japan with four Hitachi CPU's and 8 megabytes of core under one operating system.

Professor Haruhisa Ishida of Tokyo University manages the largest computer system in Japan (four Hitachi 8800 series CPUs under one operating system), but is also a personal computing enthusiast and loans out 12 different systems to students for 2-week periods.



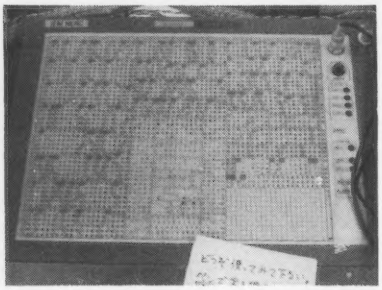
In the Akihabara area of Tokyo, one can find stalls and shops selling calculators, connectors, resistors, or computers. One building alone houses seven (!) retail computer shops along with numerous shops for hi-fi components, recorders, and small electrical appliances.

A "keyboard" with touch pen can input over 3000 Chinese characters. It outputs in a 2-byte format to paper tape which is then read into the computer.

Pertec/MITS PCC 2000

It seems a strange place to hear about the latest from PCC, but there I was at a press conference at IEE Corp, in Tokyo, and Jerry Roby of PCC was giving out with the latest. First of all, he reaffirmed PCC's decision to concentrate on the small business market using the MITS name and dropping Altair. He mentioned too that the S-100 bus was being modified to obtain hardware stability not, as some cynics have suggested, to prevent "foreign" S-100 peripherals from being plugged into Altairs (excuse me, MITS).

The new MITS PCC 2000 is an integrated system for the very small business market. It has an 8080 CPU, 64k, dual full-size floppy, 24 x 80 character screen with double density, and separate keyboard unit on a cable to the CPU/display/floppy unit. It comes with CP/M, Basic, and ISAM. Other software packages developed both internally and outside will be available through PCC. ■



New York Personal & Business Small Computer Show

Held in the New York Coliseum on September 15-17, 1978, Ralph Ianuzzi's NY P&BSC Show was as different from John Dilk's PC'78 held three weeks earlier in Philadelphia as, well, New York and Philadelphia. The New York show attracted proportionately more people off the street who wanted to see what these little computers were all about. More retail stores exhibited in New York with more elaborate exhibits than Philadelphia. Despite the newspaper strike, the crowds came and attendees and exhibitors were both generally pleased.

New York was the second show at which we had our line of tape cassettes and floppy disk software. The crowds around the demonstration PET and Apple at our booth had to be seen to be believed. We were running all eight of our tapes (44 programs) on the PET but people kept asking for **ELIZA** (Conversational Games-1) and **ANIMAL** (Educational Simulations-1). Oh the Apple, the real crowd pleasers were **Rocket Pilot, Star Wars** (Space Games-1) and **Baseball** (Sports-1).

The only real sour note at the NY Show was at closing time. The union moving crew was on dinner break and absolutely refused to let people move their own equipment. Tempers flared and the show management declined to help out, hence, most exhibitors were stuck there until 10 pm or later getting madder by the minute. Not only that, but everyone missed the premier 3-hour episode of Battlestar Galactica!

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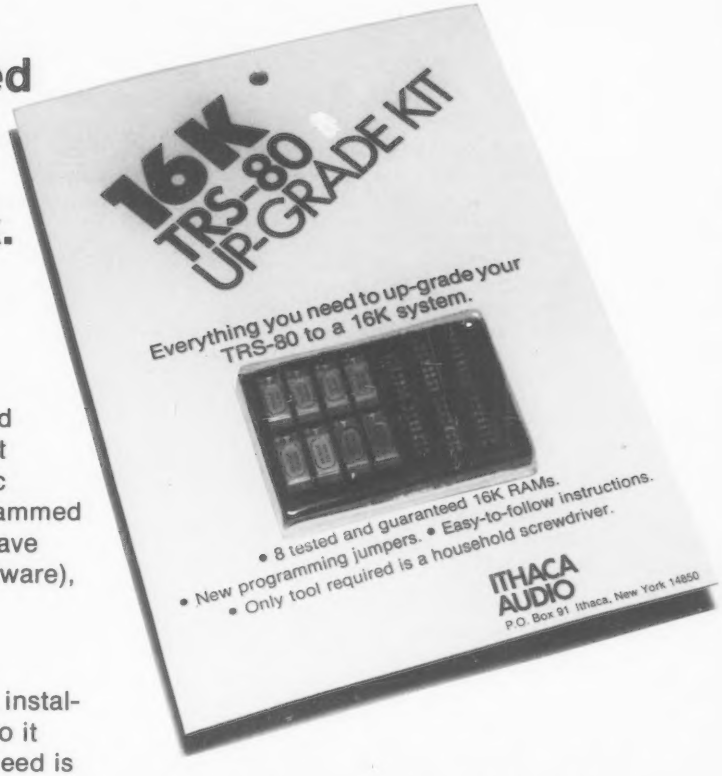
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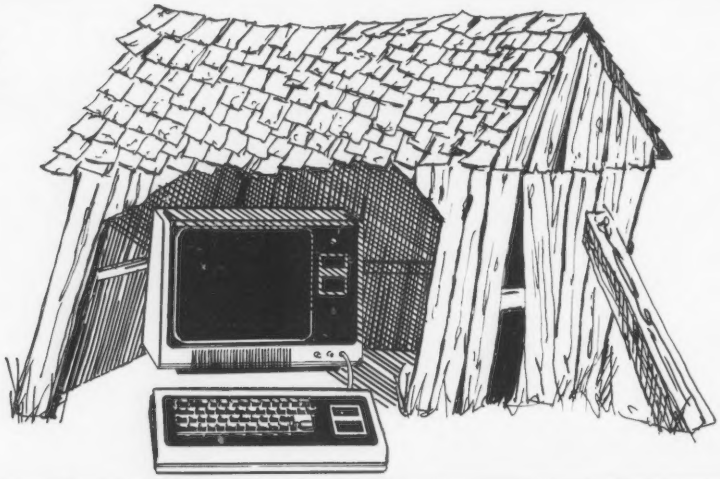
CIRCLE 109 ON READER SERVICE CARD

TRS-80 Strings

Stephen B. Gray



Up to now, I've written several articles about Radio Shack's TRS-80 off-the-shelf, ready-to-run computer, in *Creative Computing*. There were articles on the Level-I computer (Jan/Feb 1978); Level-I user's manual and the Math I and Home Recipe programs (May/June 1978); payroll program (May/June 1978); and Level-II BASIC (Sept/Oct 1978). All this software was Radio Shack's.

It's high time to switch to a regular column, as of this issue, because there are so many things available now for the TRS-80 that occasional articles just can't cover them all. There are games, educational and business programs on tape, "magazines" on cassette and on thin plastic records, adapters for non-Radio-Shack hardware, plastic covers for your machine, expansion memory and a raft of goodies being planned or prototyped all over the country.

The Personal Computing '78 show, held August 24-27 in Philadelphia, showed just what mix can be expected, for the present at least, in TRS-80/PET/Apple software. Many booths were offering software for the TRS-80, some had PET programs, and a few had Apple software.

I'll try to report on all the hardware made for the TRS-80 by Radio Shack and everybody else. As for the software, I'll check out most of what Radio Shack has to offer, and at least one cassette (or whatever medium) from each company (or individual) producing programs. I'll report on the various TRS-80 Users Group Notes, and publish interesting contributions from *Creative* readers (but no long programs, please—just clever shorties). In short, just about everything relating to the TRS-80 will be covered in this column, other than hardware modifications of a lengthy kind involving schematics and requiring a lot of knowledge about electronics.

All reporting on hardware and software products, in this column, will be on the basis of having checked them out personally.

Guide to TRS-80 Information. This 20-page offset-printed guide is a *must* for any really serious TRS-80 nut. Although, it's not very easy to read in some places, either because an old ribbon was used in typing the originals or the printer didn't do a good job, nevertheless there's a great deal of useful information here.

The eight sections cover general information (such as my article about the Level-I manual); software articles; software list (17 suppliers of TRS-80 programs—list out of date, of course, but a good starting list); other software sources (author not quite sure just what the 32 sources offer); hardware articles; special hardware list (blank casettes, dust cover, RAM chips, etc.); programming information; user group and special-interest group information; bugs, ideas and tips ("take off and store back door; otherwise you'll break it." Hmmmm.); things to come (author's predictions, such as tapes to convert BASIC to Fortran and BASIC to COBOL).

The guide was "compiled, edited and annotated" by Richard A. Heubner and is available from his wife: Mrs. Florence E. Heubner, Box 37206, Oak Park, Michigan 48237, at $3 each; 2 to 9, $2.50; 10 or more, $1.90 each. Full refund if not satisfied.

Fourteen year old Ralph Lipe took top honors at a recent Fort Worth Regional Science Fair by writing a TRS-80 program that guides a person step-by-step through the 1040-A tax form. The program took Ralph (shown here with his parents) 60 hours to write and debug.

CLOAD Magazine. Publisher Ralph McElroy describes CLOAD this way in his flyer: "This magazine is the ultimate in computer magazines. You Can't Read It!! (Your computer can.)"

By first-class mail every month, subscribers get a C-30 audio cassette to "pop into your TRS-80 computer and go." The five or six programs on each cassette are a mixture of games, "practical programs," education and trivia. A year's subscription is $36 (was $24 until September 1978, due to what the April CLOAD called "poor financial judgment"), six months for $20, $3.50 for a single issue. Address: CLOAD Magazine, Box 1267, Goleta, CA 93017.

I've run the first six issues of CLOAD, starting with the first, dated March 1978. Ralph had some problems at first, but so does any innovator (remember the original Altair 8800?). The April issue, according to the comment sheet packed with the May issue, contained "some data ... that would load, but it would not run, nor would it list. That's right folks, it was not a program.... We had a data 'block' prepared for this month's graphing program, but we decided not to put it in because our mass duplicators had a hard time with

April's data block." Several of the early issues were mailed out late; I got my June issue on July 31. However, most of the bugs have been removed and CLOAD deserves your attention.

According to the notes I wrote while checking out the May CLOAD, which was the first I tried, "Couldn't get the asterisks to flash. Pulled out the black EARphone plug, as the blue comment sheet says to do, to hear when the program starts so I'd know when to expect the flashing asterisks. Heard a voice! Must be the publisher [it was the editor], giving greetings, apologizing for the April issue being so late, saying there'd be no background music for this issue, may not use it in future, caused problems."

Not until the June comment sheet did CLOAD let subscribers in on what may still have been a mystery to some: "Listen to the tape. With your ears, that is. We have had many people complain that programs wouldn't load, or would load only on one side. There is speech in there folks—it won't load at any level. There won't be any speech from this issue on, because we're out of room on the tape." The June issue was the first to put the programs on one side of the cassette in Level-I BASIC, and on the other in Level-II. Actually, some of the programs that appear in Level-II are reissues of old programs previously written only in Level-I BASIC.

Incidentally, if you don't know by now, the big difference between the Level-I and Level-II programs is that the abbreviations permitted in Level-I, such as P. for PRINT, aren't allowed in Level-II. That's what the conversion tape sent with Level-II machines is for: to convert P. to PRINT, G. to GOTO, etc.

The mix of programs on CLOAD may not please everybody, but could *you* select five or six programs that, printed in these pages, would be guaranteed to turn on every *Creative Computing* subscriber?

The first issues had audio that announced what programs were on the tape, as well as having labels on the cassette shell to indicate, with reasonable accuracy, where each program started according to the tape counter, assuming you'd reset it to zero before starting. There are two tape-counter numbers, because each program is recorded twice, just as Radio Shack double-records each program on their cassette tapes. "This will give you," as the hints-and-tips now sent with all Radio Shack programs says, "a back-up if one does not load properly or if it becomes damaged."

Each CLOAD now starts with a standard opening, without audio: it's a program the label calls COVER, and it's just like the cover of a magazine. Except that, below a top portion that presents CLOAD in 1¼-inch-high matrixed letters made up entirely of the little rectangular graphics blocks, there are continually-changing graphics, repeating the same program over and over, until you BREAK and then load the next program.

The first CLOAD COVER showed a fairly simple design, described in the April comments as a "last-ditch effort by yours truly," due to the unfortunate fact that "artistic creations have a way of refusing to adhere to a publishing schedule." Later COVERs were more interesting (and sometimes more confusing): a series of stock-market curves (April); early U.S. flags (May); a random group of graphics blocks that get blasted off the screen by a patiently searching blaster (June); a group of various-sized rectangles (July); and concentric ellipses with randomly-selected sizes and placements (August).

Curiously, the COVER has been describing CLOAD as "The Audible Magazine" ever since the June issue, which was the first to *drop* the audio because there was no room for it.

Frankly, the audio portion of CLOAD was a nuisance. You had to change the setting of the CRT-41's volume control back and forth when the tape changed from audio to data, or vice versa, and it wasn't all that easy to remember each time to do it.

Now to get down to the programs themselves. The first issue, March 1978, had CM&ML, a metric guessing game in which you're shown volumes and lengths and asked what are the milliliters or centimeters in each case; BREAK, in which a brick is thrown at a window, but halfway in the trajectory the brick becomes invisible, and you have to guess when it will hit the glass, and the closer the brick gets to the glass before you hit BREAK, the higher your score; SAND CASTLE, in which you build a mountain (not a castle, really) 18 layers high, using sand, gravel and brick, with rules that make it interesting until you realize that the game can be beaten by figuring it out from the top down, and you could even write a subroutine to do this; LOGIC is Mastermind with numbers; and CHECKBOOK is a reconciliation program.

The next five CLOAD issues include programs for games such as one-pocket pool, horserace, auto race, tic-tac-toe, pinball, Life, shoot-down-the-space-fighter, etc.; tutorials on scientific notation, algebraic factoring, and algebraic multiplication; "practical programs" such as bond yield to maturity, loan schedules, etc.; and math programs including linear regression and standard deviation.

My favorite is in the August issue: JUKEBOX, which plays, in a bass electronic buzz, very clearly indentifiable tunes through an AM radio placed "near space-bar on keyboard." The six are *Michael Row the Boat Ashore, Marines Hymn, Clementine, Oh Susannah, Silent Night,* and *The Sound of Silence*.

At this point you're sure to ask: just what sort of programming permits playing music? Well, a LIST of JUKEBOX shows that the program consists basically of 17 subroutines for each of 17 notes in an octave and a half, and six groups of lines for the six tunes, with the duration and pitch of each note specified for each tune. The first note of *Clementine*, an F, is played by these three lines:

```
40 FOR K=1 TO 17*L
41 A=A+111
42 NEXT K
```

Run just those three with L (for Length) equal to 1.8, and with an AM radio near the space-bar, and you'll hear a short beep. Change the L to 3.6, and line 41 to A=A+1, and you'll hear a C played twice as long. By substituting other expressions in line 41, you'll get different notes. Try A=12-12+1, A=A-A+123456, and A=A-A. Can you figure out why different notes are caused by different expressions?

Keeping an AM radio close to your space-bar is a good way to find out exactly when a particular program starts loading, because when it does, you get the same high tone you do when you pull out the EARplug, a good way to ruin the loading. Then you can let the TRS-80 load while you attend to other chores, until the tone disappears. Then you come back to the TRS-80 and RUN the program.

Some of the comment sheets accompanying CLOAD issues offer tutorial information on programming. And the June 1978 CLOAD included the description of modifications to the CTR-41 that "allow you to listen to the tape (at a comfortable volume) while loading its data into the computer," and change the function of the "tone hi-lo" switch so that in one position, the computer has control of the motor; in the other, the motor is always on, "handy for fast forward and rewind." This modification permanently sets the tone control to "hi."

For a sample issue to see how you like CLOAD, if you'd rather take a short look before subscribing, send in $3.50 (in California, $3.71) for the June 1978 CLOAD, which has

Knight's Tour, scientific notation and algebraic factoring in Level-I and Level-II, and PILOT (dogfight down the trench) and ZARBOR (fly the spaceship over the mountain) in Level-I. Or if you like the TRS-80 tunes in JUKEBOX, ask for the August 1978 CLOAD, which also contains LIFE (JUKEBOX and LIFE are in Level-I), bond yield and PINBALL in both, and PILOT and ZARBOR in Level-II BASIC.

CLOAD pays for programs, by the way, "from $25 or so for a front cover, to $250, maximum, for a well-coded program of a practical nature. The average program submission which is accepted falls in the $75-to-$100 category." A reader told me CLOAD bought one of his programs for $150.

Spelling mistakes look bad enough in print, but on a TRS-80 screen they really stand out. CLOAD has had bloopers such as "interast," "negitive," and, best of all, "copywritten." They've improved.

Not enough imaginative use of the TRS-80's graphics capabilities is made in many of these tapes, which is a common problem in TRS-80 software these days. Apparently most hotshot programmers aren't hotshot graphicists. Two different breeds of cat?

My only other major complaint about CLOAD is that no program contains a REM line other than one naming the author. JUKEBOX would have been much easier for me to figure out with a few REM lines, and many TRS-80 owners would surely like to figure out how the CLOAD programs work. The publisher of CLOAD says REM lines would make the programs too long. Well then, as an alternative, why not add one more page to the comments sheets and include notes on the programs themselves, telling what the various groups of lines do, explaining some of the tricky parts and pointing out the clever bits of programming? To me, that would make CLOAD worth twice as much, if not more.

TRS-80 Computing. The first issue of this new 32-page magazine (printed on paper, not cassette) is dated August 1978, and is addressed mainly to hardwaremen who want to get inside their TRS-80 and modify.

The first issue has articles on how to modify for Level-II lower case, how to have both Level-I and II on the same TRS-80, the design of the TRS-80 by its architect (Steve Leininger), how to expand TRS-80 memory to 16K yourself, how to use DOS Version 1, TRS-80 schematics (10 pages of those), etc. *TRS-80 Computing* is "published as often as monthly," by Computer Information Exchange, Inc., Box 158, San Luis Rey, CA 92068, at $10 for 12 issues.

Dust Covers. At the Philadelphia show, I saw a neat dustcover for the TRS-80 keyboard, made of "vinyl/cloth," and available from some dealers or from International Technical Systems, Box 264, Woodbridge, VA 22194, at $9.95 plus 75¢ for shipping and handling. They'll be coming out soon with a toaster-type cover for the video monitor.

Radio Shack Computer Centers. Plans to open 50 computer sales and service stores in 1978 and 1979 were announced in late August by Lewis Kornfeld, president of Radio Shack, who said, "While some will be located within new or existing Radio Shack stores, most will be separate entities, and all are expected to be in major markets. They will be called Radio Shack Computer Centers and their purpose will be to assist area Radio Shack stores in answering computer questions and closing sales, and to develop quantity sales, principally of Radio Shack TRS-80 microcomputer systems and peripheral equipment, to businesses and institutions."

"The stores," Kornfeld continued, "will provide market-area service on Radio Shack computer products, thus extending to nearly 100 the number of service facilities operated by Radio Shack in this country and will include classroom areas where the company can teach computer use and programming to its customers and prospects."

In addition, the centers will display and sell "a variety of pieces and parts, as well as packaged software and possibly hardware items of makes other than Radio Shack," Kornfeld said.

Customer Service. If you've got hardware or software problems with your TRS-80, there's a customer service number to call in Fort Worth, Texas: (817) 390-3583. Don't be surprised if it takes you awhile to get through, because at the last count, over 7,500 calls a week were being made to that number, and by the time you read this, the count may be up to 10,000 a week.

Next. Saw many other TRS-80 goodies at that fine show, Personal Computing 78, will report on as many as I can in the next TRS-80 sTRingS column. ■

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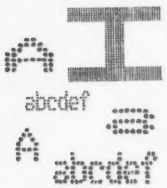

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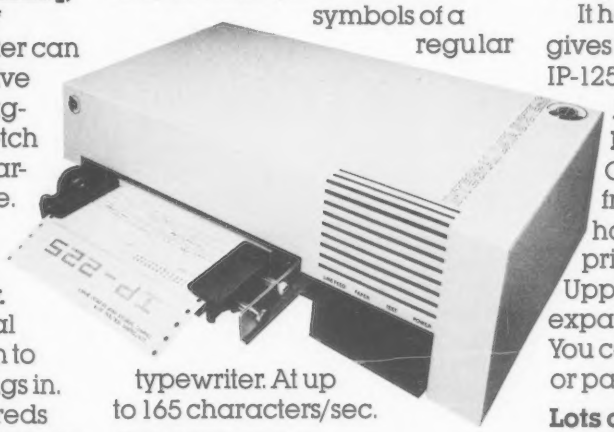

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Personal Electronic Transactions

by Gregory Yob

I am happy to hear from you, and encourage your correspondence. I will try to acknowledge all correspondence, and a SASE makes things easier for both of us. Please send your letters to "Personal Electronic Transactions" c/o PO Box 354, Palo Alto, CA 94301.

It is my pleasure to bring to you a column about the Commodore Pet personal computer. As many of you know (especially PET owners), the documentation available from Commodore is rather scanty, and after you have struggled for many hours to get your PET to do a simple thing, you might conclude that you own a Personally Exasperating Thingamabob. It is my hope that this column will help remove some of these frustrations and help you become a competent and happy user of your PET(s).

The scope of this column is everything and anything to do with the PET, with one deliberate omission. When I go to visit some of the PET user clubs, a major topic of conversation is Commodore, with an equal mixture of "When will" questions, and variously vehement complaints. The subject of Commodore, pro, con, and when, will, *not* be covered here for two major reasons: First, Commodore *did* make a real machine that runs when you turn it on, comes up in BASIC, and can be made to do interesting, useful and fun things without too much trouble. In the personal computing field, this is a major accomplishment!!! To underline this, I should mention that my IMSAI, though perfectly functional, hasn't been turned on in the last 8 months, and I use my PET nearly every day.

Second, I was an employee of Commodore from December 77 to April 78, and I do not feel that public complaints about Commodore's Service and responsiveness to their customers will have much impact on Commodore. I leave it to you to wonder why.

As a PET owner, the first thing you probably want is some information on the machine - here is a brief list of the PET related publications that I have come across. Most of these carry advertisements by hardware and software suppliers for the PET as well as programs, software exchanges, bibliographies, etc. If you ask for their back issues, you will have a wealth of information sources for the PET.

PET Information Sources

The Transactor
Commodore Business Machines, 901 California Ave, Palo Alto, CA 94301. Free to PET owners.

This is mostly an advertisement sheet sent monthly to registered PET owners (you must send in your warranty card), and announces the PET peripherals (tape unit & printer & floppy discs to date) and software to be available.

The XXX Paper
(formerly PET Paper) PO Box 43, Audubon, PA 19407. $15.00 for 10 issues.

This is a monthly publication, mostly oriented to beginners, and carries articles describing BASIC, some of the PET's odd features, and lists a variety of software & hardware.

PET User Notes
PO Box 371, Montgomeryville, PA 18936. $5.00 for 6 issues.

This is a monthly publication with a wide variety of notes concerning the PET, and two or three interesting program listings per issue. It also carries advertising for software & hardware.

PET Gazette
1929 Northport Drive, Room 6, Madison WI 53704. Free on request by individuals.
3This is a monthly publication with extensive listings of PET suppliers, various technical articles, and a large software exchange.

A lot of information in this one.

SPHINX Newsletter
Lawrence Hall of Science, Computer Project, University of California, Berkeley, CA 94720. $3.00 for 6 issues.

This is the newsletter for the two Bay Area PET clubs, PET Users Group and SPHINX. It carries many rather technical articles and some product announcements.

People's Computers
PO Box E, Menlo Park, CA 94025. Monthly magazine, $8.00 per year.

A general magazine for computerists, and carries one or two articles on the PET per issue, usually oriented towards the beginner.

Calculators/Computers Magazine
PO Box 310, Menlo Park, CA 94025. $10.00 for 6 issues/year

An educationally oriented magazine with two or three PET articles in each issue.

Personal Software List
A compilation of PET, TRS-80 and APPLE software programs and vendors for $2.00. PO Box 466, El Dorado, CA 95623

So, don't wait for this column - get copies of the above, and you will be gaining even more!

As mentioned at the bottom of this column, I welcome correspondence, and I will try to acknowledge all of it. As this is inviting a flood of mail. I cannot guarantee replies to most letters, but I will use their content to help choose what to present in future columns. Remember that my 'lead time' is about 3 months.

As an example, the following clears the screen, prints a ball in the center, and then says hello: PRINT "clr rt rt rt rt rt rt rt rt rt rt rt rt rt rt rt rt rt rt rt rt dn dn dn dn dn dn dn dn dn dn dn dn Q dn dn lft lft lft HELLO"
NOTE: You will notice that the PET special function keys will provide

some queer-looking symbols if you press them after entering a quotation mark. As drawing these would be just as difficult as doing all the graphics characters, we will, from now on, ignore what actually appears on your PET when you make a LISTing - you will eventually grow familiar with these odd creatures, and my purpose is to make it easy for you to duplicate the various programs and amusements that I am presenting to you.

(Perhaps we can persuade somebody to make a 10 pitch Selectric ball for the PET set?? (sigh) This is my fourth attempt at making a usable PET to typewriter translation, and at least this one is typable!!)

When you turn on your PET and diddle with the graphics keys, you will notice that some groups of keys provide "construction kits" for certain types of pictures. Let's take a look at some of these and see what they might be good for.

The first group is the "playing card kit". This is the set of symbols for the card suits using the keys: **A S Z X**, which are spade, heart, diamond and club respectively.

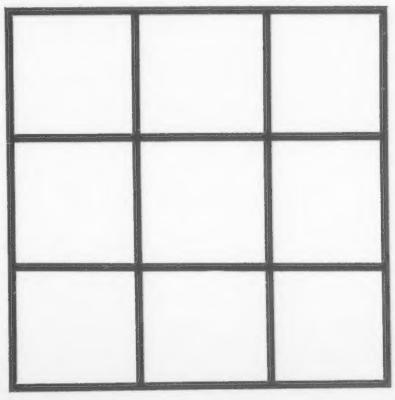
The second group I call the "box kit" for it is handy for making forms, playing boards, and the like. These keys are:

@] for horizontal and vertical sides
0 . - = for the corners
[1 2 3 + for interior parts and edges

Here is a little program that draws a tic-tac-toe board which uses all of these characters:
(NOTE: All spaces will be indicated by 'sp'.)

```
10 PRINT "clr dn dn dn dn dn dn"
20 PRINT TAB(15) "0 @ 2 @ 2 @."
30 PRINT TAB(15) "] sp ] sp ] sp ]"
40 PRINT TAB(15) "+ @ [ @ [ @ 3"
50 PRINT TAB(15) "] sp ] sp ] sp ]"
60 PRINT TAB(15) "+ @ [ @ [ @ 3"
70 PRINT TAB(15) "] sp ] sp ] sp ]"
80 PRINT TAB(15) "- @ 1 @ 1 @ ="
```

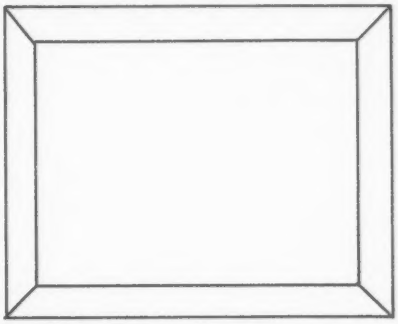
Here is a diagram of what you should see on your PET screen when you RUN this program:



If you want to have your corners rounded, the "Addition to the box kit" will give you nice corners. These are the characters **U I J** & **K**. As an exercise, change the tic-tac-toe program to have rounded corners.

The third group is the "other box kit" and is made of:
O P L : for the corners
 # $ % ' for the sides
V N M for diagonals

This group is more difficult to use, and as a challenge to you, write a program that draws a "picture frame" using this kit of characters.



A Little Bit on PET Graphics

When you press a PET key along with the SHIFT key, you will see a graphics character appear on your screen. There are 64 of these, corresponding to each of the alphanumeric keys. Before we go farther into this, there is the problem of showing you the graphics and cursor movement keys in the printed page. The solution I have adopted goes as follows, and you are advised to make a copy for reading future columns. (Unless I can persuade John Craig to publish this in each issue!)

PET Listing Conventions

1) Uppercase characters, numbers and punctuation represent themselves only. For example, 10 PRINT "HI THERE, THIS IS AN EXAMPLE !!!" is just exactly that.

2) **Underlined** characters in upper case, numbers and punctuation represent the corresponding GRAPHICS character. For example, 10 PRINT "**QWQWQWQW**" will print eight "balls" alternating with full and empty ones. If you see an uppercase letter, or a number, or punctuation with an underline, it means to press the SHIFT key as well.

3) Lowercase letters mean that a PET special purpose key is being used. These are shown below:

sp	space-usually only when there might be some confusion as to how many.
clr	clear screen (CLR key)
hm	home cursor (HOME key)
in	insert character (INST key)
del	delete character (DEL key)
up	cursor up
dn	cursor down
rt	cursor right
lft	cursor left
rvs	reverse field on (RVS key)
off	reverse field off (OFF key)
run	Load & go (RUN key)
stop	halt program (STOP key)

The fourth group is the "ramp kit" and consists of two groups of lines:
 # E D C @ F R $ horizontal "ramp"
% T G B] H Y ' vertical "ramp"

A few moment's thought brings an interesting discovery - each set has eight characters, one for each possible horizontal and vertical line. Since the PET has 25 lines vertically, and 40 characters horizontally, a limited form of 'high resolution' plotting is possible. You can select one out of 320 positions across the screen, and one out of 200 positions vertically. In the next column I will show some plotting programs that use this feature.

The next group of characters include those in "reverse field", that is, when you print them, the (rvs) key has been pressed first, exchanging the black and white areas. The first example of this is the "bar graph set". For convenience, I am including the (off) character as well, for when you are using these in a program, you might not know if the PET is in reverse field mode or not.

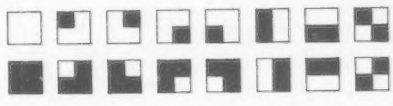
off sp, off %, off **4**, off **5**, off **!**, rvs **6**, rvs *, rvs ' and rvs sp - horizontal bar graphs set
off sp, off **$**, off /, off **9**, off ", rvs **8**, rvs **7**, rvs # and rvs sp - vertical bar graphs set

In the next column I will show some programs using these characters for bar graphs.

The next set has been discovered by many, and is the "double density plotting set". The PET has 16 characters which represent all possible patterns in a 2 x 2 cell:

off sp, off , off , off , , off ; , off **!**, off ", off **?**,
rvs sp, rvs , rvs , rvs , , rvs ; , rvs ", rvs **?**

For those of you without PETs, the above characters look like this:



Again, the next column will explore these characters too.

A few of the PET graphics characters have been omitted, namely, **& / ( )** and . I have found the last two handy for drawing big letters & sym-

bols on the screen. The three "grey" characters, which look like miniature checkerboards when viewed closely, do not seem to be used very often. They often appear in borders, and the & is used to simulate the cursor.

Simulated Cursors

It is all too easy to use the INPUT statement in BASIC, to discover later that when a program is running that you have pressed RETURN without entering anything - and your PET comes back with READY., and your program is no longer running. This friendly behaviour is especially nasty if you are in the midst of an exciting game, or a long & important program.

This PET "feature" will most likely appear when you are showing your PET to a friend who is new to computers, and that's the time you want your program to be as "idiot-proof" as possible.

Fortunately, the PET has a way to enter single characters without stopping the program, and permits *all* of the characters, including RETURN. This is the GET statement. When you use GET to enter a string, any key which has been pressed previously will be returned to you as a one-character string. If no keys have been pressed, an empty (or null) string will be returned.

If you are displaying instructions, for example, it is handy to let the user press any key to go on to the next page of information. Here are two very useful lines of BASIC code for the PET:

```
10 PRINT"      some instructions
20 PRINT"      some more instructions
               ...etc.
300 PRINT"     last of this bunch of in-
               structions
310 PRINT"     dn PRESS ANY KEY";
320 GET A$:    IF A$="" THEN 320
330 PRINT"clr  start of the next page of
               instructions
```

Line 310 tells the reader that when he is done, to press a key to go on. It is important to provide this, by the way, for when a computer just "sits there," it is very confusing to try and decide what the right thing to do is - so always tell your user what he is expected to do.

Line 320 has two statements. The first one, GET A$, looks at the keyboard and fetches any character that might be there.

The second one (notice the colon is a statement separator) checks if A$ is empty. If A$ is empty, the thing to do is try again until a character is found. This is simply a jump to the same line the GET A$ is found in. The two quotation marks must be next to each other - if you try IF A$ = "sp" you are checking for SPACE instead of "no characters entered".

Let's try our hand at making a cursor which blinks, and doesn't look like the PET cursor (this is a subtle way of telling the user that the program is running ok). Here is a first attempt:

```
10 PRINT "ANYTHING: sp";
20 PRINT "& 1ft";
30 GET A$: IF A$ ""  THEN 100
40 PRINT "sp lft";
50 GOTO 20
100 PRINT "OK"
110 GOTO 10
```

The program prints "ANYTHING : " and waits for you to enter a character - when you do so, it prints "OK" and does it again. Line 20 prints the false cursor (the little grey character), and line 40 prints a SPACE to erase it. Notice the cursor left which puts the cursor on top the & or sp as the case may be.

When I RUN this program, I see the & all right, but it doesn't blink! The reason is that the program is blinking it too fast for me to see. If a little delay is added:

```
25 FOR J = 1 TO 10 : NEXT
45 FOR J = 1 TO 10 : NEXT
```

A very rapid blinking 'cursor' is now evident. To adjust the speed, change the lines 25 & 45 by making the loop longer. A count of around 200 is about the same speed as the PET cursor.

You might find that a different speed is more comfortable to use - some friends I know find the PET cursor very annoying. You might try other characters (one good one is rvs **V**) and try making the time "off" different from the time "on" by making one delay loop longer than the other one. I would like to hear from you regarding the most comfortable kinds of 'cursors'.

See you next issue.....

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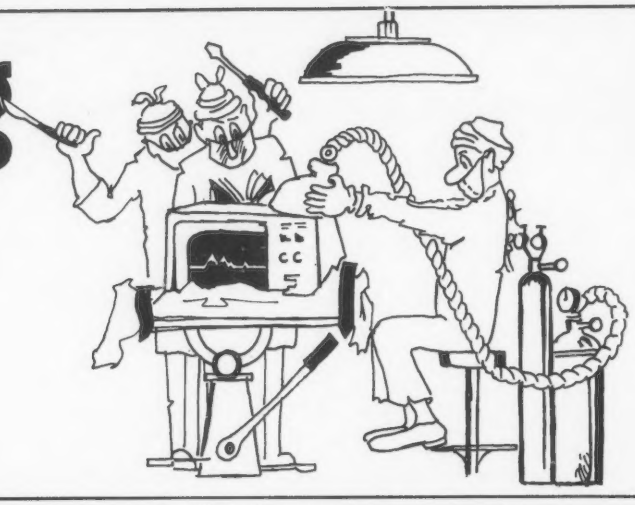
John Craig



With the ever-increasing use of operating systems with personal computers it seemed the time was right for a column to answer reader's questions on this complex subject. This column will be devoted to both disk-based and high-speed cassette operating systems. Some of the questions might concern the capabilities, operation, software which can be run, problems, compatability with other OS's, costs, availability, updates and whatever else you can think of. If you've got a question regarding your operating system, or one you're thinking of getting, we hope you'll go directly to your typewriter, put it down on paper and send it in. The chances are there are many others who want the same question answered. It's called sharing...and we all benefit from it.

The talent we have lined up to answer your questions is very impressive. Here's a list of the headliners (and if they can't get the question answered, for whatever reason, we've got an equally impressive backup "crew"):

PolyMorphic Systems — Don Williams is Poly's #1 jetsetter and in between flying around the county getting dealers established, he'll answer inquires on the Poly 88-10, 88-13 and 88 systems.

Digital Group — David Bryant, is a student at the University of Southern California who writes operating systems in his spare time. He wrote DISKMON and PHIMON, Digital Group's disk and Phi-deck operating systems.

CP/M — Tony Gold, founder of the CP/M User's Group.

Alpha Micro — Dick Wilcox is the man behind Alpha Micro's AM-100. The hardware (a 16-bit microprocessor based on the PDP/11) was his concept and he's put all the software together into one of the most sophisticated packages on the market today.

North Star Computers — Chuck Grant is the President of North Star and the man who helped develop North Star's DOS and Basic. (We threw the first question his way to get the ball rolling this month.)

Processor Technology — Steve Dompier is one of the real pioneers in personal computers. (Did you ever hear the story about how he returned from a trip to Albuquerque NM in early 1975 with an Altair tucked under his arm? He took the thing to one of the first meetings of the Homebrew Computer Club and was commenting on how MITS was unable to get memory boards manufactured ... boards which worked. Bob Marsh walked up to Steve and, as he was holding one of the MITS 4K dynamic boards, said something like "I'll bet we could start a company and manufacture 8K boards for this computer." So was born Processor Technology!) Steve has been in on the development of PTDOS, their operating system for the Helio disk system. (He also wrote a fantastic video game called "Target" which keeps my kids in a tying-up-computer mode for hours!)

MECA — Derryl Millican, will take care of any questions which arise concerning his company's Alpha-1 Cassette Operating System (MECOS — a dual Phi-deck system) for their Delta-1 Disk system...or a combination of the two!

ICOM — Art Childs, former editor of SCCS Interface magazine, wrote FDOS-III and maintained FDOS-1 & II when he was with ICOM and Pertec (as one of their super programmers).

Southwest Technical Products — Dave Shirk, President of Technical Systems Consultants (TSC), is the man behind SWTP's new disk operating system, FLEX.

Like I said, it's a rather impressive lineup. I just hope you'll keep those cards and letters coming so we can keep all of them nice and busy! And (VERY IMPORTANT), do not send inquiries, questions, or whatever directly to the people I've listed. All correspondence should be sent to:

Operating Systems Q&A
Creative Computing
PO Box 789-M
Morristown, NJ 07960

To get things going, we posed the following question to Chuck Grant:

Q: "Recent literature indicates that the latest version of North Star's DOS, Release 4, provides a capability for coming up running in a user's Basic program. Is this a difficult thing to implement? In any case, would you describe the procedure?"

A: Being able to simply power up and begin executing a Basic program gives the programmer great flexibility over the operating environment he wants to provide to users of his system. For example, a games diskette could be created that merely needs to be inserted into the disk drive at power on. The user would immediately be able to communicate with a "menu" program that helped him select a game. The user would not need to know anything about DOS or Basic.

The procedure for setting up a Basic program to be loaded and executed at power-on consists of two parts:

1.) Create a file containing Basic and the desired Basic program.

2.) Inform DOS that immediately after bootstrap load, the designated file is to be loaded and executed. (Note that any program file can be designated as the file to be run, not just Basic programs.)

The details of the procedure involve using DOS, Basic and the North Star Monitor. Step-by-step instructions are given in the Release 4 documentation." ■

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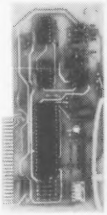
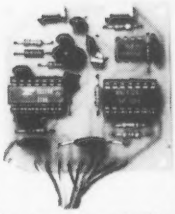
APPLE II SERIAL I/O INTERFACE *



Part no. 2
Baud rate is continuously adjustable from 0 to 30,000 • Plugs into any peripheral connector • Low current drain. RS-232 input and output • On board switch selectable 5 to 8 data bits, 1 or 2 stop bits, and parity or no parity either odd or even • Jumper selectable address • SOFTWARE • Input and Output routine from monitor or BASIC to teletype or other serial printer. • Program for using an Apple II for a video or an intelligent terminal. Also can output in correspondence code to interface with some selectrics. Board only — $15.00; with parts — $42.00; assembled and tested — $62.00.

MODEM *

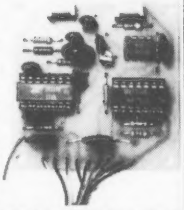


Part no. 109
• Type 103 • Full or half duplex • Works up to 300 baud • Originate or Answer • No coils, only low cost components • TTL input and output-serial • Connect 8 ohm speaker and crystal mic. directly to board • Uses XR FSK demodulator • Requires +5 volts • Board $7.60; with parts $27.50

DC POWER SUPPLY *

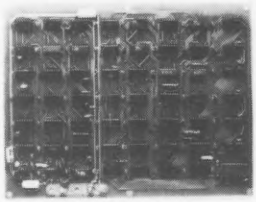
Part no. 6085
• Board supplies a regulated +5 volts at 3 amps., +12, -12, and -5 volts at 1 amp. • Power required is 8 volts AC at 3 amps., and 24 volts AC C.T. at 1.5 amps. • Board only $12.50; with parts excluding transformers $42.50

TAPE INTERFACE *



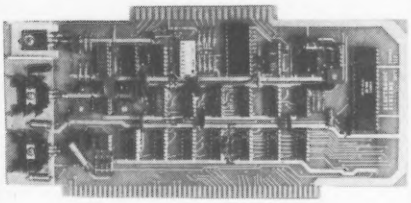
Part no. 111
• Play and record Kansas City Standard tapes • Converts a low cost tape recorder to a digital recorder • Works up to 1200 baud • Digital in and out are TTL-serial • Output of board connects to mic. in of recorder • Earphone of recorder connects to input on board • No coils • Requires +5 volts, low power drain • Board $7.60; with parts $27.50

T.V. TYPEWRITER



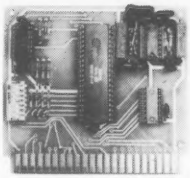
Part no. 106
• Stand alone TVT • 32 char/line, 16 lines, modifications for 64 char/line included • Parallel ASCII (TTL) input • Video output • 1K on board memory • Output for computer controlled curser • Auto scroll • Non-destructive curser • Curser inputs: up, down, left, right, home, EOL, EOS • Scroll up, down • Requires +5 volts at 1.5 amps, and -12 volts at 30 mA • All 7400, TTL chips • Char. gen. 2513 • Upper case only • Board only $39.00; with parts $145.00

TIDMA *



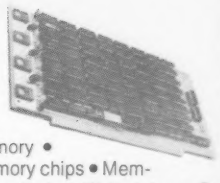
Part no. 112
• Tape Interface Direct Memory Access • Record and play programs without bootstrap loader (no prom) has FSK encoder/decoder for direct connections to low cost recorder at 1200 baud rate, and direct connections for inputs and outputs to a digital recorder at any baud rate. • S-100 bus compatible • Board only $35.00; with parts $110.00

UART & BAUD RATE GENERATOR *



Part no. 101
• Converts serial to parallel and parallel to serial • Low cost on board baud rate generator • Baud rates: 110, 150, 300, 600, 1200, and 2400 • Low power drain +5 volts and -12 volts required • TTL compatible • All characters contain a start bit, 5 to 8 data bits, 1 or 2 stop bits, and either odd or even parity. • All connections go to a 44 pin gold plated edge connector • Board only $12.00; with parts $35.00 with connector add $3.00

8K STATIC RAM

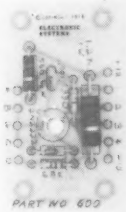


Part no. 300
• 8K Altair bus memory • Uses 2102 Static memory chips • Memory protect • Gold contacts • Wait states • On board regulator • S-100 bus compatible • Vector input option • TRI state buffered • Board only $22.50; with parts $160.00

RF MODULATOR *

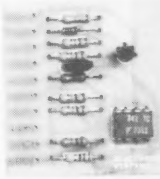
Part no. 107
• Converts video to AM modulated RF, Channels 2 or 3. So powerful almost no tuning is required. On board regulated power supply makes this extremely stable. Rated very highly in Doctor Dobbs' Journal. Recommended by Apple. • Power required is 12 volts AC C.T., or +5 volts DC • Board $7.60; with parts $13.50

RS 232/TTY * INTERFACE



Part no. 600
• Converts RS-232 to 20mA current loop, and 20mA current loop to RS-232 • Two separate circuits • Requires +12 and -12 volts • Board only $4.50, with parts $7.00

RS 232/TTL * INTERFACE



Part no. 232
• Converts TTL to RS-232, and converts RS-232 to TTL • Two separate circuits • Requires -12 and +12 volts • All connections go to a 10 pin gold plated edge connector • Board only $4.50; with parts $7.00 with connector add $2.00

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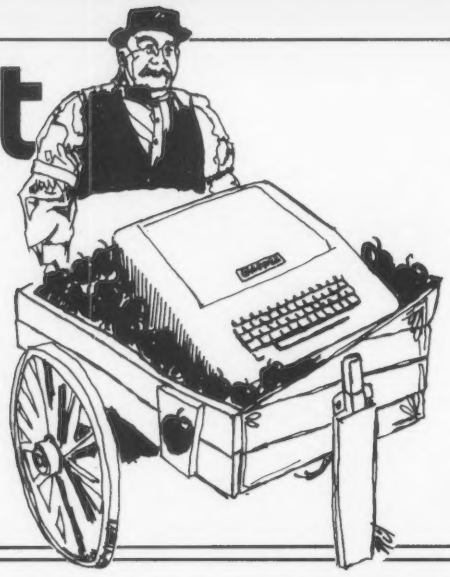


by Richard A. Milewski

Dick Milewski is president of The Software Works, Inc. (PO Box 4386, Mt. View CA 94040), a company which has developed several application packages for North Star disk-based systems. They are currently developing similar application programs for the Apple.

Apricots to Apples

In old San Francisco during the Gold Rush Days, fresh fruit was so scarce that apples sold for more than a dollar each. As a result, the wheat farmers in the region around Cupertino, California, began to plant orchards. By the end of the 1850's the entire valley was filled with fruit trees, and Cupertino was the heart of the apricot producing region. Today all but a few of the orchards are gone. In their place is a staggering array of high technology companies. A few blocks from some of the last remaining apricot trees, on the spot where the Bochser orchards stood before the turn of the century, a new kind of "orchard" is producing Apples. Not the large red fruit, but a small very capable, personal computer. Built around the 6502 microprocessor, the Apple II computer includes a built-in keyboard, a video interface capable of producing color graphics which can only be described as spectacular, a cassette recorder interface which enables the user to save and re-load programs on tape, a pair of game paddles, and even a speaker which can be programmed to provide a variety of clicks and beeps and even a little music. The Apple II can be ordered with anywhere between 4 and 48 K of random access memory (RAM) and includes a *very* fast integer BASIC in read only memory (ROM). Systems with 16K or more of RAM include a cassette tape with Applesoft, the Apple II version of Microsoft BASIC.

As this is the first in an ongoing series of columns on the Apple and it's uses, perhaps we should take a moment to preview what we hope to accomplish in the future. The main emphasis will be on software. Each month we will present brief reviews of interesting pieces of software developed specifically for the Apple II personal computer. Special effort will be made to describe products which run on small to medium sized systems (generally 16K or smaller). We will also attempt to bring to your attention software products produced by small companies and individuals, which might otherwise escape unnoticed. For those of you who want to do more than just load programs written by other people, we will include a section devoted to programming tips and techniques designed to sharpen your programming skills, and to let you get the most from your Apple II.

While the main thrust of this column will be toward software, hardware accessories for the Apple II will not be entirely ignored. Of special interest in this area is the Apple Disk II. The feature which distinguishes the Apple II from other small,. ready to run personal computers is that the Apple Computer Company is *delivering* add-on floppy disk systems, not just announcing them. The implications of this difference will become apparent in the next few months as a vast array of very practical applications software becomes available to take advantage of the disk. The importance of the floppy disk system to a small computer lies in the very differences which distinguish the circular recording surface of the diskette from the long ribbon of tape in the cassette. To locate an item (either a program or a piece of data) on the end of a cassette tape the computer must read the entire tape before it can get to the required item, much like a person getting a drink from an old fashioned well must reel in the entire rope before he gets to the bucket. A floppy disk is a "random access device." That means that any point on the disk may be loaded very quickly without the necessity of reading any other point first. This is rather like selecting a particular "cut" on a record by picking up the record player tone arm and placing the needle at the beginning groove of the selected song. Next month we will begin our Tips & Techniques section with a discussion of data files as used on the Apple disk.

Software Reviews

Each month we will be reviewing notable new software products for Apple II. In an effort to treat each product fairly and to provide a means of comparing similar products reviewed in different issues of the magazine as time goes on, we have devised the rating scheme outlined below:

The software will be rated on a scale of 1 to 4 in each of the following categories:

1. Documentation. Good documentation should be complete and easy to understand. For large programs and/or packages of programs intended as business applications the documentation should provide sufficient information to permit modification of the software to meet the specific requirements of a given business. User documentation should be free of computer jargon and be complete enough to enable a non-computerist to operate the system.
2. Utility/Completeness. Each program will be evaluated as to how well it fulfills its stated purpose. Games must be entertaining (and perhaps even educational). Accounting programs must be able to do arithmetic operations.
3. Ease of Use. A large portion of the development effort of a good piece of software goes into the human interface, i.e., making the software natural and easy to use. (Asking a yes or no question by requiring a zero or one in response is *not* good human engineering.)
4. Creativity. By now, everyone with a computer around the house has been inundated with Startrek, Lunar Lander and Wumpus programs. High creativity scores will be given to software with fresh approaches to old problems and to programs which present new ideas for the use of small computers. (Fear not, all ye Startrek freaks, the Apple II has superlative graphics capability and creativity points will be scored for using it well.)
5. Over All Rating. This category has been thrown in to permit the reviewer to become subjective about the matter. A large number of factors which do not fall into any of the above categories should be considered when evaluating software, and rating systems which fail to account for them tend not to give a fair picture of the programs.

1 = Poor 3 = Good
2 = Fair 4 = Excellent

Program Name:
Appletalker™
Written by:
Bob Bishop and Bill Depew
Publisher:
Softape
10756 Vanowen
North Hollywood, CA 91605
Order Number:
ATB-778
Price:
$15.95
Memory required:
16K

Software Rating

Documentation	2.5
Utility	3.5
Ease of Use	3.5
Creativity	4
Over All Rating	3.5

Appletalker is a program which enables the user to digitally record spoken words, to store then in tables in the Apple's memory and to replay them through the built-in speaker in the Apple II. The program may be used in a standalone mode to store a number of speech tables in memory or the machine language routines which store and play back the tables may be saved separately and then called from a user written program. The possibilities brought to mind by this delightful piece of software are endless; error messages that talk back, enemy starships with captains who make derisive comments, lunar landers which land to the cheering of mission control or crash with the sounds of twisting metal and shattering glass...While the words sound much like they've come from an old Edison Victrola, everything is quite understandable and Appletalker opens a whole new bag of tricks to the imaginative Apple owner! (Incidentally, additional hardware is not required. Appletalker uses the Apple's built-in speaker.)

Program Name:
DRAWING
Written by:
Ron Graff
Publisher:
Magnemedia, Inc.
17845 Sky Park Circle, Suite 4
Irvine, CA 92714
Order Number:
DRAWING
Price:
$7.50
Memory required:
4K

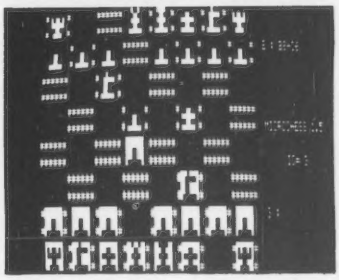
Software Rating

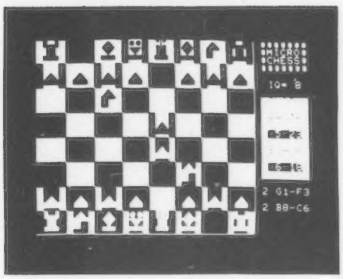
Documentation	3.5
Utility	2
Creativity	1
Ease of Use	3
Over All Rating	1

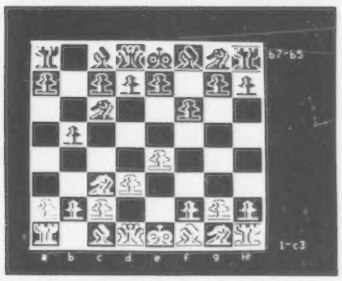
This disappointing little program is designed to pick a name at random from a list of up to 15 names. The names are entered, the selection process is initiated and the names are displayed at random 100 times. The last name displayed is considered "selected." The documentation for this program is, however, above average. The booklet which comes with the program not only describes the operation but details modifications to the program to permit a permanent list of names, and to prevent a name which has previously been selected from reappearing. In addition to the written documentation, voice instructions are recorded on the reverse side of the tape so the software will literally talk the user through the operation of the program. (We did get the impression that the speaker would have benefited from a session or two at the Close Cover Before Striking School of Broadcasting.) If all of this isn't enough, Magnemedia offers full program listings and programmer's notes for $1.00.

Drawing is, we feel, overpriced and it's primary purpose in life seems to be to act as a "stuffer" in a two program package with a teacher oriented "Grading Routine" ($12.00 for the pair). Our original intent was to purchase the set, and to review the Grading Routine in this column. The program, however, failed to run properly and Magnemedia advised us over the telephone that the cassette itself was probably defective. We are returning the cassette to them and will report on this promising looking product (as well as how well Magnemedia supports a user with a problem) in a future column. ■

TRS-80 PET APPLE







PLAY CHESS WITH YOUR COMPUTER!

MICROCHESS is the culmination of two years of chessplaying program development by **Peter Jennings**, author of the famous 1K byte chess program for the KIM-1. MICROCHESS 2.0 for 8K PETs and 16K APPLEs, in 6502 machine language, offers 8 levels of play to suit everyone from the beginner learning chess to the serious player. It examines positions as many as 6 moves ahead, and includes a chess clock for tournament play. MICROCHESS 1.5 for 4K TRS-80s, in Z-80 machine language, offers 3 levels of play (both Level I and Level II versions are included and can be loaded on any TRS-80 without TBUG). MICROCHESS checks every move for legality and displays the current position on a graphic chessboard. You can play White or Black, set up and play from special board positions, or even watch the computer play against itself! Available now at a special introductory price of only **$19.95**

BRIDGE CHALLENGER by **George Duisman** for 8K PETs, Level II 16K TRS-80s, and 16K APPLEs: You and the dummy play 4 person Contract Bridge against the computer. The program will deal hands at random or according to your criterion for high card points. You can review tricks, swap sides or replay hands when the cards are known. No longer do you need 4 people to play! **$14.95**

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VB-MD10	5" 10 sectors hard-sectored for North Star	$5.95	$4.50	$4.00	$37.
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CIRCLE 143 ON READER SERVICE CARD

reviews

Stephen B. Gray

The Z-80 Microcomputer Handbook, by William Barden, Jr. Howard W. Sams & Co., Inc., 4300 West 62 St., Indianapolis, IN 46268. 304 pages, paperback $8.95. 1978.

This compact and useful handbook, which requires a fairly good knowledge of microcomputers to understand, was written to provide both current prospective users with a good look at the Z-80 hardware, software, and some microcomputer systems that use the Z-80. The hardware section has eight chapters: historical introduction, Z-80 architecture, interface signals, addressing modes, instruction set, flags and arithmetic operations, interrupts, and interfacing memory and I/O devices to the Z-80.

An equal number of chapters (and pages) on Z-80 software looks into the assembler, moving data, arithmetic and logical operations, shifting and bit manipulation, list and table operations, subroutines, I/O and interrupt operations, and some commonly-used subroutines.

The two chapters on Z-80 microcomputers discuss products from the Z-80's manufacturer, Zilog (a microprocessor development system and several boards) and from four microcomputer manufacturers: TDL, Cromemco, The Digital Group, and Radio Shack. (How fast this field moves! TDL is now Xitan).

****

Payroll With Cost Accounting—In BASIC, by Lon Poole and Mary Borchers. Osborne & Associates, Inc., Box 2036, Berkeley, CA 94702. 365 pages, paperback $12.50. 1977.

The ninth book on microcomputers from Osborne & Associates, and the second in their series of BASIC program books, *Payroll With Cost Accounting* is a hefty, fully-packed paperback that includes program listings, descriptions, discussion of the principles behind each program, the forms layouts, and a user's manual with step-by-step instructions, flowcharts, and sample reports and CRT displays.

Features include separate payrolls from up to 10 companies, interactive data entry, easy correction of data-entry errors, job costing (labor distribution), check printing with deduction and pay detail, and 16 different printed reports, including W-2 and 941.

The programs were developed over the five years that Osborne & Associates has been a vendor of business software packages, specifically for Wang computers. The programs are all written in Wang Laboratories standard BASIC. For other variations of BASIC, some programming changes will be necessary, especially for the file-access portions.

****

Basic Software Library: Volume VIII, Homeowners Programs, by Roger W. Brown. Scientific Research Inst., Box 490099, Key Biscayne, FL 33149. 96 pages, paperback $19.95. 1978.

The latest in the SRI series of program books for fun, math, engineering and business, volume VIII includes five long programs and an appendix with five short ones. All programs are in BASIC, with LISTs and RUNs, and each "has been successfully run on a G.E. 635 computer."

1040 TAX assists in preparing a Federal tax return, with itemized deductions or standard; BALANCE reconciles bank statements; CHECKBOOK balances a checkbook; INSTLO78 computes real cost on bank-financed items such as a car or boat; and DEPREC2 computes depreciation, with four methods, for any time period. The five require for execution, respectively, in bytes: 13K, 16K, 5K, 2K, 2K.

The short programs are conversions of earlier SRI programs

to full compatibility with microcomputer BASIC: INSTALLMENT (3K) calculates monthly payment schedules; INTEREST (5K) computes accrued interest on installment loans; MORTGAGE (4K) prints mortgage schedules; REGRESSION (13K) calculates standard deviation of residuals, etc.; TEACH ME (8K) should be called TEACH THE COMPUTER THE ANIMALS, because it learns how to guess a wider and wider variety of animals you're thinking of.

****

The Mind Appliance: Home Computer Applications, by T.G. Lewis. Hayden Book Co., Inc., 50 Essex St., Rochelle Park, NJ 07662. 144 pages, paperback $6.95. 1978.

According to the press release, "The serious computer hobbyist who has tired of playing games now can advance to the household appliance computer with this new guide.... Your computer will write poetry, balance a checkbook, score musicals, automatically dial a telephone, and draw graphics." The book's cover promises applications for the garage (actually, this is a chapter on the fundamentals of BASIC), living room (sports statistics retrieval and two other programs), kitchen (recipe system, menu program), bedroom (poetry composition), den (check-writing, household budget), bathroom (graphics, torpedo game), split-level home (bowling scores, telephone dial program). There are several other programs, for a total of 18, all in BASIC; the garage chapter includes programs for giving change, shuffling 52 items, and generating a pseudorandom number. The graphics program seems to have been written for the Tektronix 4051 computer, since it draws perfectly straight lines, and uses statements such as WINDOW, VIEWPORT, and DRAW. The really serious hobbyist will enjoy the long sections on English parsing techniques, disk files, and hashing.

****

Small Computer Systems for Business, by Gerald A. Silver. McGraw-Hill Book Co., New York. 271 pages, paperback $9.95; solutions manual $2.95. 1978.

This text provides an overview of microcomputers and minicomputers for students, business people, managers and small business operators. Five chapters discuss the hardware, going into basic principles, systems, CPU fundamentals, peripherals and mass-storage devices, with many photographs, drawings and diagrams. Another five chapters cover software: introduction, assembler, interpreter (BASIC), compiler (FORTRAN) and operating systems. The last chapter, on applications, shows how small computers might be used in nine imaginary organizations: an engineering company, a college, an airline, a hospital etc. Three appendixes provide information on numbering systems, the ASCII coding system and flowcharting symbols.

Exercises at the end of each chapter ask the reader to "Define a Hollerith constant and give two examples," or to "Prepare a READ statement which inputs two integers," for example. A solution manual is available to educators.

****

The Home Computer Handbook, by Edwin Schlossberg, John Brockman and Lyn Horton. Sterling Publishing Co., Inc., New York. 250 pages, hardcover $10.95. 1978.

The handsome full-color cover conceals an uneven text with few illustrations and much out-of date information. Over half the book is appendixes; the rest contains little real meat. All the photographs are in a cluster of 16 pages; all seven diagrams are hand-drawn. The book seems to have been too hastily assembled, by people not familiar with home computers.

The section on programming says, "If you want BASIC in your computer, you have to put it there." Yet the very next page mentions BASIC in ROM. The subtitle of the chapter on programming is "A Thorough Introduction." In seven pages? There isn't a single example of a program in the entire book.

A couple of chapters may be of interest, although the one on the state of the art in home-computer products doesn't mention

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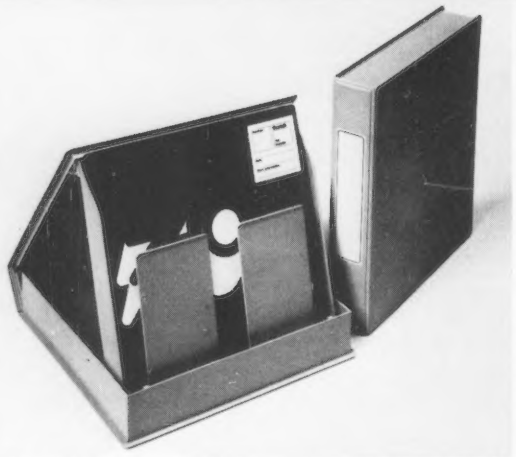

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the Z-80. One appendix gives information on Data General, DEC and H-P computers, as if of interest, and on companies long out of existence, such as Mikra-D, Sphere and EBKA. The list of stores and clubs is sadly out of date, as is bound to happen in a book that takes months to produce.

****

57 Practical Programs & Games in BASIC, by Ken Tracton. TAB Books, Blue Ridge Summit, PA 17214. 204 pages, paperback $7.95. 1978.

The author, a "veteran computer programmer," has generated an interesting collection of programs that will run on any floating-point BASIC. According to the preface, "they will operate even with a simplified subset of BASIC."

The 57 programs are presented in alphabetical order. Most are short, from 12 to 63 lines long. Three games are longer: Blackjack takes 115 lines, One-Arm Bandit 80 lines, Space Wars (1) is 133 lines long, Space Wars (2) takes 287 lines. The other games are Craps and Number Guess.

Math and accounting programs include Compounded Amounts, Straight-Line Depreciation, Chi-Square Evaluation, Gaussian Probability Function, Hyperbolic Functions, matrix inversion and Harmonic Progressions. Engineering programs include Hydrocarbon Combustion, L-Pad Minimum Loss System and Pi-Network Impedance Matching. To round out the mix, the author includes Day of the Week and I Ching.

Each program is neatly presented with an explanation, LIST, flowchart and RUN. A little heavy on the math, but a worthwhile addition to your library of BASIC programs.

****

Microcomputers At a Glance, by Donald D. Spencer. Camelot Publishing Co., P.O. Box 1357, Ormond Beach, FL 32074. 192 pages, hardcover $11.95, paperback $7.95. 1977.

Intended as a basic reference book for all microcomputer users, this dictionary of technical terms contains about 2500 words, phrases and acronyms related to microcomputers and microprocessors, along with three dozen photographs (of personal computers, largely) and diagrams.

The definitions, all written in very clear style, are for words and phrases ranging from "compiler" to "mask" and from "allocation" to "zero flag." Acronyms include BNF, CAL, ECL, and MSD.

As an example of the clarity of the definitions, under "compiler" is this: "A computer program that produces a machine-language program from a source program that is usually written in a higher-level language by a computer user. The compiler is capable of replacing single source-program statements with a series of machine-language instructions or with a subroutine."

This is a helpful reference for even the most knowledgeable worker in microcomputers, since few if any of us can keep the exact meanings of these several thousand words and phrases in our minds at all times.

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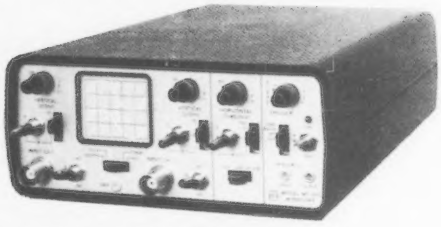

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The CP/M Disk Operating System

Steve North

Among microcomputer users, there are several standards which have arisen, not because some committee created them, but because people found them to be worthwhile and used them. This is true of the S-100 bus, Microsoft BASIC and CP/M, which is most likely the best microcomputer disk operating system available.

CP/M, which stands for Control Program/Monitor, was developed by Digital Research of Pacific Grove, California. It's designed for use with 8080/Z80-based microcomputers with IBM-3740 compatible floppy disk drives. It is available as unbundled software, which you can customize to your own terminal and disk interface. However, CP/M is also used by Tarbell, INFO 2000, Dynabyte; and by Cromemco and IMSAI in slightly modified form, to name just a few.

To most computer types, the term "operating system" refers to some kind of huge, monstrous collection of software, including some kind of head honcho program that decides what's going to happen, a collection of handy utilities, language processors, and what have you. Furthermore, it should be capable of handling common chores, like I/O, for other programs. In this respect, CP/M is in an entirely different class than most other microcomputer disk operating systems, which often function more like "disk monitors," just allowing you to load or save memory segments, print a catalog, or execute some file on disk. Additionally, if the proper CP/M conventions are observed, software is completely transportable from one system to another, regardless of the actual terminal or disk drive in use. So part of CP/M's power is derived, not just from its outstanding capabilities, but also that it serves as a common software interface for microcomputer users.

CP/M is designed to allow device-independence in handling I/O (though obviously you can't make a papertape look like a random disk file). Up to four floppy disk drives are supported—they are referred to as A:, B:, C:, and D:. You don't have to have four drives to use CP/M (one will do) though you won't have much luck accessing peripherals you don't have. CP/M also supports I/O with a system console, reader, punch and list device (line printer), which may be assigned to various physical devices. File names for disk files consist of three parts: an optional letter prefix which indicates on which disk don't include this, a default is assumed), then the eight-character name of the file and then a three-character extension; as in "B:TESTFILE.BAS". The extension generally identifies what the file contains. BAS is usually a BASIC source file, HEX is machine-language object code, FOR refers to FORTRAN source code, etc.

In certain instances, ambiguous file references are allowed. A ? serves as a don't-care character, and an * as a string of don't-cares. Thus, B???????.BAS refers to any file beginning with the letter B and with the extension BAS. TESTFILE.* refers to the file TESTFILE with any extension. *.* refers to all the files on a disk. Obviously you can't use an ambiguous file reference for, say, opening a file, but this can be very handy when you want a selective directory of all the BASIC programs on a disk.

CP/M provides dynamic allocation of disk space, meaning that the system knows where to find free space on a diskette and can use it when needed. That may sound rather obvious, but in most other microcomputer DOS-es it is common for a "deleted" file on a disk to take up space, until a separate pack operation is performed (at the user's command).

Under CP/M, memory is broken up into four sections, as follows:

1) The System Area, which contains system parameters, vectors, file control blocks, buffers, etc. Always the lowest 256 bytes in the system.

2) The Transient Program Area. This extends from 100 hex upwards in memory. Here is where user programs, utilities and other stuff running under CP/M loads and executes.

3) The Console Command Processor, which accepts and executes your commands. This is near the top of memory.

4) BIOS/BDOS (which stands for Basic Input Ouput System and Basic Disk Operating System), above the CCP. These are hardware dependent routines which handle low-level I/O with terminals, disk drives, etc.

IBM-3740 compatible disks have 77 tracks, each of 26 sectors of 128 bytes. On a CP/M disk, tracks 0 and 1 are reserved for a copy of CP/M system. Track 2 contains the directory, and the rest of the disk is used for regular files. Interestingly enough, you can't just take your CP/M-format disk and read it in with normal IBM access methods, because CP/M has a different directory format and IBM uses that funny character code. (One enterprising outfit sells conversion programs to translate CP/M disks to IBM, and vice versa, for $200.) When the CP/M system is cold-started (generally by executing a short bootstrap loader in ROM) CP/M is loaded off the diskette and the CCP routine is entered.

The CCP (Console Command Processor) allows you to enter system commands. Its prompt, a letter followed by a , indicates the current default drive. The CCP actually only has five built-in commands: DIR to print a directory, TYPE the contents of a file, REName a file, SAVE memory in a disk file and ERASe a file. If the CCP doesn't recognize a command, it can look on the disk you specify (or the default) for a file of that name with the extension COM. So if you have a program named SORT. COM you can execute it merely by typing SORT. The machine-language object file named SORT.COM will be loaded into the TPA and executed. Additionally, you can pass parameters to this routine in the same line, perhaps the name of a file to be processed (so you could enter SORT B:TESTFILE.DAT).

Several command files for handling fairly sophisticated functions and utilities are provided with CP/M, and you can write others yourself or obtain them from other CP/M users. (There is an active CP/M User's Group, run by Tony Gold. They presently have 24 CP/M diskettes of free software. There aren't many user's groups that can measure their software libraries in *megabytes!*) CP/M includes the following command files:

ED, a sophisticated text editor used for the preparation of source programs or

other text on disk. The editor operates on lines or characters and uses a pointer which moves through the text, rather than line numbers. It can be used with any kind of terminal.

ASM, a standard 8080 assembler which assembles to and from disk.

DDT, a Dynamic Debugging Tool, used for debugging 8080 machine-language programs. DDT permits you to step through a program, examining memory and CPU registers as they change, and can also do simple assembly/disassembly on code in memory.

SUBMIT, is a program which executes CP/M macro-procedures contained in a disk file. For instance, in order to work on a BASIC program you first want to edit the source file, then call in the compiler, then call in a runtime interpreter. Using SUBMIT you could write a procedure to automatically execute all these steps, with symbolic parameters to represent the name of an actual file you want to use when the procedure is executed. For lack of a better analogy, SUBMIT could be compared with IBM JCL procedures, except that CP/M is an interactive environment.

MOVCPM and **SYSGEN,** are useful for modifying CP/M for your particular system and making copies of it. When you get CP/M, it is configured for a 16K system and Intel MDS I/O, which obviously not too many people have. However, all the information you need to write your own I/O routines, for your disk and your terminal, and information on implementing CP/M for bigger memory sizes, is included in the manual. Frequently you can also get help in bringing up CP/M from the people you bought it from, too.

STAT, allows you to examine and modify the status of system devices.

PIT, for Peripheral Interface Program, is a very handy utility used for moving data from almost anywhere to anywhere. For instance, you can use it to copy disk files from one drive to another or to load a file from the reader or dump a file to the punch.

For those who do assembly-language programming, the CP/M documentation explains clearly how to use the operating system to handle things like disk file opening, I/O with the console, etc.

Currently, CP/M is the best supported microcomputer DOS and the gap will no doubt widen with time (though the North Star DOS has its good points, too, and is also well-supported). Already, there are at least three BASICs which can be used under CP/M: BASIC-E, a "compiler" which generates an intermediate, hypothetical machine code, which can then be interpreted at fairly high speed; Microsoft Disk Extended BASIC, a very sophisticated interpreter which has become a standard in itself; and C-BASIC, a version of BASIC-E with extensions for business applications. BASIC-E is in the public-domain, so it can be obtained for little more than the cost of the media. Several FORTRAN compilers exist, and there are at least two or three COBOLs for those who care about it. Digital Research sells a CP/M-compatible super macro-assembler, symbolic instruction debugger, and a text formatter. Also available are sort packages, business applications, the powerful Electric Pencil word processor and even a PASCAL compiler!

In short, CP/M is an extremely convenient and powerful framework of systems software useful for developing and running your own programs. For more information on CP/M, read "CP/M Primer" in the April 1978 issue of *Kilobaud,* and the manuals available from Digital Research. CP/M on floppy disk, with complete documentation costs $70, the documentation alone is $25. Digital Research, P.O. Box 579, Pacific Grove, CA 93950. (408) 649-3896.

Owners of iCom disk drives may be interested in the ICOM-CP/M Upgrade Kit, from the Computer Mart of New Jersey. The iCom FDOS is not as flexible or widely-used as CP/M, so this is quite useful if you have an iCom disk unit. The upgrade kit consists of a 2708 EPROM and a CP/M System Diskette, already customized for your system. Merely remove the 2708 already on the iCom disk interface board, plug in the new EPROM, and you can now run both CP/M and the old iCom FDOS on your disk. The standard entry points in the EPROM are retained (apparently there was enough free space in the original iCom EPROM for a CP/M boot loader, too). You just go to address COOO to use the iCom FDOS, and C3CC for CP/M. CP/M is loaded in two stages. The first phase is a simple disk loader, the second phase determines if there is a file named INITIAL on the disk, and loads and executes it under CP/M if there is such a file. This allows true turnkey operation for application programs. Complete documentation is included.

Obviously, you could write your own I/O routines for the iCom disk to use with CP/M, and program your own 2708, but this kit can save you much time in developing this software, and is well worth it. $180, from the Computer Mart of New Jersey, 501 Route #27, Iselin, N.J. 08830. (201) 283-0600. ■

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The "Most-Software" Machine

...North's Star complete system: the Horizon

John Craig

Can't decide between a mini or standard-sized floppy system? Here are some points to help make up your mind.

Ninety thousand bytes on one diskette? A lot of people feel you need more mass storage for most applications...but that's all you get with a single mini-floppy drive. You can increase it to 180,000 bytes with a dual drive system but when compared to the 250K available on a single standard-size floppy it would still seem to be a little on the short side. Aha, but something new has come on the scene! North Star has developed a controller for Shugart's double density, double sided mini drives. We now have a whole new ballgame...where a three-drive system will provide on-line accsss to over ONE MEGABYTE of mass storage! All the old arguments against mini-floppy systems have become just that, "old arguments."

I would have to agree that the 90K byte capacity of a normal mini-floppy simply isn't adequate for many applications. On the other hand, there are probably just as many applications which can be satisfied using the smaller drives. The hobbyist can get by with that kind of storage capability, it'll do for most educational applications, and, if you stop and think about it, there are a multitude of small businesses that are truly small businesses (i.e., they don't have horrendous inventories or customer files). Dual drive mini systems are already in use in many such businesses around the country so it isn't just a though. .t's a reality.

So much for the hardware. It's time we got down to some equally important matters; the software. If I made the statement, "There is more software in existence which will run on the North Star Horizon than any other micro system in the world," what would your reaction be? I hope it got you a little fired up because it sure did me when the thought first came along. I'll tell you what...why don't you come along on this little trip into S-100 "Software Land" and decide for yourself the validity of the statement?

By the way, I believe in objective reviews. Although I like the Horizon system (and there's nothing wrong with that) the following write-up will discuss the good points, as well as the bad.

The Selection Game

There are five major considerations when looking for a computer system...for any application. Number one is to determine exactly what the application is going to be and then find the software to do the job. The potential buyer should not be going out and looking at hardware and asking, "Does this thing have the software to do what I want it to do?" Find the software...then the hardware!

Once we've found that software, it's time to select the hardware configuration which will run it. Naturally, this means looking for a system with a microprocessor (8080, 6800, Z-80, etc.) which will run the programs...along with the necessary peripherals.

The third element in our selection criteria is a fairly new one; the operating system. A short time ago (one to two years) most of us working, and playing, with personal computer systems were quite content just to have the thing up and running...and being able to load and run programs from a cassette recorder (very slowly, I might add). An operating system was just a glean in the eye. Now it's much more than that...it's a necessity. The factors that make it important, for any application, are that programs can easily be run under control of the operating system (rather than in a standalone situation as before), interfacing the hardware to the system is much easier, operation of the entire system is easier and, perhaps most importantly, the good software being developed today (particularly for small business applications) is being developed to run under a particular operating system.

The fourth consideration in our system selection process is the manufacturer. In number 1 we determined the application...number 2, the hardware requirements...number 3, the operating system...and now we're going to go find a manufacturer who can provide us with the whole thing. We

The perfect companion to the Horizon is the Soroc terminal, on the right, which North Star sells for $995. There are a lot of things I like about the Horizon but one of the smallest, and yet most important, is the fact it's so quiet! The disk drives are quiet . . . and if it wasn't for the light on the front you wouldn't know it was on because the fan is so quiet!

aren't going to go shopping for a board here and a board there to make up the system. That's one way to put a system together. However, it's not very desirable. The reason for not taking that approach is simple: we don't want to spend our time troubleshooting and interfacing the whole thing...we want to get busy and do some computing! The term "S-100 compatible" sounds nice but there are instances when one manufacturer's S-100 board is not totally compatible with someone else's S-100 board (i.e., they won't work together). Some money can be saved by putting together a system piecemeal, but the question of how much time can be devoted to the project definitely needs to be answered. (If you have plenty of time and troubleshooting expertise then perhaps the next comment won't be too significant for you.) The Horizon is a complete system which can be bought as a kit or fully assembled and tested. I personally don't think there's any substitute for getting it assembled and tested. But, the important point is that the entire system comes from one manufacturer. The Z-80 CPU board, the 16K RAM boards, disc controller, drive(s) and the motherboard (which contains serial and parallel I/O logic) are all made by North Star. They all work with each other...the way S-100 compatible boards are supposed to. I have two S-100 systems in my office. One is the Horizon and the other is somewhat of a "bits & pieces" system. The latter is a good system (which is being used to write this article — using Electric Pencil II) but it had more than its share of problems trying to get up in the beginning. The Horizon arrived one afternoon after a couple of friends and I had finished a frustrating day of troubleshooting that system. I took the Horizon out of its box and commented, rather sarcastically, "You know, the only thing I have to do to get this one up and running is connect the terminal (via the RS-232 connector coming out of the rear), plug in the power cord, put in a diskette and turn it on." I practically had those 4 steps accomplished by the time I was through with the sentence! And I really didn't expect it to come up that easily...but it certainly did! (I might add that it's been running flawlessly for several months since...until just a couple of days ago, when one of the disk drives decided to die on me.)

The final selection criteria is the dealer you buy the system from. Here's another case to be made for getting the system from one vendor. The computer store will be able to provide you with better support if your system is easier to maintain and he has to interface with only one manufacturer in the event something goes wrong. That after sales support is tremendously important (especially if you're looking for a business or school system). If the store can't provide it...then look elsewhere. The servicing of any computer, large or small, and keeping the down-time to a minimum, is a #1, hot priority item!

The All-Important Operating System

Now we're going to get to the meat of the matter and find out the reason why this is the "most software" machine. It's really very simple; the two most popular microcomputer operating systems available today will run on a North Star system! And, as a result, all of the software developed for those operating systems can be run!

The two operating systems are North Star's Disk Operating System (DOS) and Digital Research's CP/M (Control Processor/Microcomputer). The amount of applications software that has been developed for the North Star DOS is mind-boggling. Most of this software has been developed using North Star's Basic. Therefore, we can safely say that North Star's Basic is as popular as North Star's DOS (since it runs under DOS). You can pick up copies of any of the popular personal systems magazines and find ads for various North Star software packages and articles about North Star programs (written in Basic). We're going to review some of the most popular packages in this article and provide a source for getting some rather lengthy lists of North Star software.

The Mountain of Software
Lifeboat Associates

The amount of software that has been developed to run under CP/M is truly significant. CP/M was originally developed for standard-size floppy systems (8 inch) and has been around for several years (i.e., very tried and proven...with a lot of people writing programs to run under it). Lifeboat Associates (164 W. 83rd St., New York NY 10024) came up with the idea of putting CP/M on the smaller 5 inch discs. They've done it...a lot of people are happy with it...and it only costs $145.

What does it mean to be able to run CP/M on a North Star system? It means (once again, thanks to Lifeboat Associates) that you're going to be able to run Microsoft's Extended Disk Basic, Fortran-80 and Cobol-80. The Basic alone is enough to make it worthwhile because of the tremendous number of Microsoft Basic programs which have been written. (It is, after all, the most popular Basic in the microworld.) We've got a review of Microsoft's Fortran coming up in Creative so I'll hold off on any discussion of it right now (plus, we should have something on Cobol). The Basic sells for $300, Fortran for $400 and the Cobol is $625. Some new packages from Microsoft, which Lifeboat is offering, include a Macro-80 Assembler (which has a linking loader and library manager) for $179, a Fortran subroutine library as an option to the macro assembler (an additional $100), and a context line editor, called Edit-80, which will be selling for $95.

Lifeboat must be offering all of Xitan's software. The list is so long I don't see how any of it could have been left out! You can get Xitan's Super Basic, Disk Basic, Z-TEL Text Editor & Text Output Processor, Macro Assembler, Z-Bug, Linker and Fortran IV...all on North Star mini-floppies!

And, just to make sure they haven't overlooked anything, Lifeboat is carrying Digital Research's Macro Assembler (MAC), Symbolic Instruction Debugger (SID), and their Text Formatter (TEX). Very high-quality packages...after all, they were written by the people who developed CP/M! (We've got reviews of the first two coming up in Creative Computing.)

Structured Systems Group (in Oakland CA) has licensed Lifeboat to distribute some of their business system packages on North Star. These include a Name & Address Processing program, called NADS, which certainly appears to be a good mailing/customer list management package. Structured Systems sent us a copy of the NADS program to review (for this article) but, unfortunately, they never sent a copy of CBASIC to run it with! The documentation is top-rate and the only reservation is that I wish there had been some examples when the field selection methods were discussed. Also, it would have been nice if the manual had discussed how many entries could be made on one diskette. In addition to being able to select names and addresses based upon any of the fields, NADS provides even more selection capability through a 127-byte reference field at the end of each record. All, or portions of, those 127 characters can be sorted on (i.e., you can break it up any way you want). This would be very useful customer lists since the reference field could be set up to provide a complete history of the customer...and much more. One of the disadvantages of this software is that only the object (INTermediate) code is made available to the customer. Therefore, making changes to the programs is virtually impossible (as is stealing them). Having to shell out another $95 for the CBASIC might also be considered a detrimental point. Another package, which runs with NADS, is a sorting program called QSORT. NADS sells for $79, QSORT is $95 and CBASIC is $95 (from Lifeboat Associates).

Tony Gold, of Lifeboat, started a CP/M User's Group some time ago (which is separate from Lifeboat). They have over 24 volumes (diskettes) of

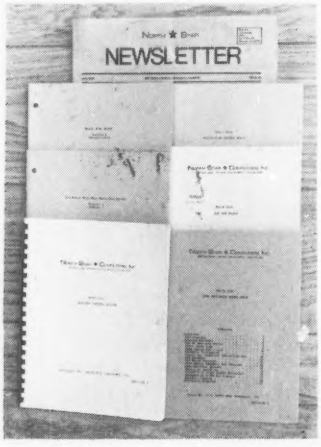
software submitted by members. There's a slight ($4) membership fee along with a small copying charge for the diskettes. Drop him a line for more information because they've put all that CP/M software on North Star diskettes...and are now looking for a distributor. (By the time this is published they should have someone lined up.)

Just *some* of the North Star software available from Lifeboat Associates. On the left we have all of the Digital Research CP/M documentation provided with each copy of CP/M, instructions for implementing CP/M on a North Star system (you just insert the Horizon version ... and run!), diskettes with Microsoft Basic and Fortran (which also come with manuals). On the right we have the NADS and QSORT documentation (very good) shown with standard-sized diskettes (and how did they sneak into this article?!).

North Star Newsletter

It's always impressive when a company puts forth the effort to keep in touch with their customers. North Star Computers put out a couple of newsletters in 1978 with that objective in mind. Their May '78 issue is the one you want a copy of, okay? It contains several pages of reviews and sources for software written for North Star Systems. (As a matter of fact, there are about 40 listed.) Also listed are the programs available from the North Star Software Exchange (utilities, math routines, games and application programs).

The newsletter also discusses the features of their latest version of Basic and DOS (Release 4). One of the strongest features of North Star's Basic has always been its disk file handling capabilities. Release 4 has some new features in that area. For example, you can now create, delete and list files from within Basic (instead of having to return to the DOS, as with Release 3). Automatic line numbering, an append command for merging two files, true random numbers, the ability to come up executing a Basic program at system power-up are just some of the new features. (That last one is especially important for systems that are going to be operated by novices. Keeps things nice and simple.) Release 4 of the DOS also provides for optional output device selection and paging of data output to the CRT or printer.



The documentation which comes with the North Star Horizon is top-rate ... with the exception of the Basic manual. It's very poor as far as providing examples of how the various commands and statements can be used. It was actually written more for the professional Basic programmer ... rather than the newcomer. They're in the process of generating a new version of the manual which should be an improvement.

Michael Shrayer Software

This article is being written using Electric Pencil II ... and I swear by it! Michael Shrayer Software (1253 Vista Superba Dr., Glendale CA 91205) has recently made his word processing system available for North Star DOS ($125). If you do any kind of text preparation at all you'll develop a strong attachment to a good word processing system ... once you've started using it. The ability to just sit down at the keyboard and toss your thoughts into the system, without regard to proper sentence structure, punctuation and spelling adds a whole new dimension to writing. You can come back an hour or a day later and clean it up, rearrange it, delete it, or whatever. It's a lot different than trying to do the same thing with paper and typewriter ... a lot different!

It takes a while for a newcomer to get accustomed to the commands and directives used with Pencil, but not much more than a day or two. It's a cursor-oriented system which requires a Processor Technology VDM-1 video board, or something similar, and comes in versions for a multitude of systems and printers (including the Diablo Daisy-Wheel). The only shortcoming I've experienced with the system is the fact my typing speed is slowed down somewhat when using it. Pencil doesn't require you to watch your line length and do a return at the end of each line ... it does it automatically. If the word you're typing at the end of the line won't fit it will automatically be placed at the beginning of the next line. If you continue typing while the word is being shifted down to the next line (a split second), a character will invariably be lost because the system was busy doing the shifting. Therefore, I find myself slowing down considerably at the end of each line.

(By the way, Electric Pencil I is the version which runs under North Star DOS, and sells for $125. Electric Pencil II is the CP/M version and sells for $175 on the mini-diskette.)

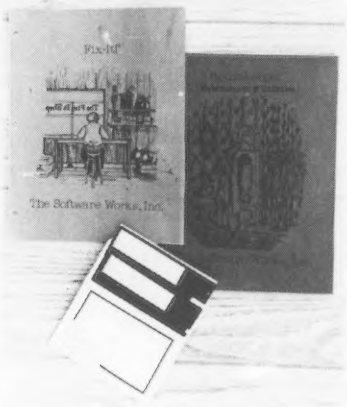
The Software Works

These people put out some fine products! The review comments in the North Star Newsletter concerning their Inventory-1 stated: "This system is certainly a candidate for the title of 'Most Beautifully Documented Program of the Year.'" So true. Not only do they do a fine job of explaining how to run their software, they also provide some very good tutorial material on file handling in several of their manuals. They're currently offering two application programs and two utility programs: Mailroom, an interactive mailing system/customer list package; Inventory-1, a 940-item inventory control program; Housekeeper, a collection of useful North Star utility programs; and Fixit, a program for "fixing" Release 3 programs so they'll run under Release 4.

As with all the software developed by the Software Works, their Mailroom was designed to be used by the end user ... not computer professionals. The program features menu selection for such things as entering new names and addresses, deleting entries, establishing new files, merging files, printing labels and sorting files by zip code or soundex (i.e., finding particular names, even if they're misspelled). There are 28 commands total ... I've only mentioned a few. One of

the nicest features of the system is the check made on each entry to insure that it isn't a duplicate. If the operator has trouble remembering the commands, typing "HELP" will list them on the CRT and "EXPLAIN" will provide a 3-line description of each command. Mailroom sells for $99.95, which includes source listings on diskette and a 55-page users manual.

Along with getting the "Best Documentation of the Year" award we ought to nominate the Software Works for the "Best Illustrations of the Year," also. Mary Milewski does the artwork for their manuals ... and it's delightful! The two manuals on the left are resting on a copy of the Software Work's Newsletter. They do a fine job of keeping customers happy and updated.



Inventory-1 is the first of a "family" of inventory control programs from the Software Works. As with Mailroom, the package is very user-oriented and interactive. The system was designed for businesses with fairly small inventories (940 items) and novice operators. Inventory-2, the next generation, handles up to 2000 items and provides a rudimentary order entry capability. Inventory-3 has a multi-level bill of materials processing capability (for handling "exploded" parts lists). We should have a review of one, or all, of these systems in an upcoming issue of Creative.

Housekeeper is a collection of some very useful utilities (such as disk copying, system status reporting, file renaming, directory listing and sorting, file editor and search functions, four sort routines ... and that's only a sampling). Housekeeper sells for $49.95 and includes a 38-page manual and source code on diskette. Due to the fact North Star fixed an error in Release 3 of their Basic (in Release 4), a problem arose in which Release 3 programs would not run under Release 4. The Software Works has developed a program, called "FIXIT," which will "fix" the older programs so they'll run under the new version ($19.95). The Software Works, P.O. Box 4386, Mt. View, CA 94040.

Alpha Data Systems

Do you have a friend who is in real estate ... and property management? Well, you oughta pass the word about the Property Management system from Alpha Data Systems (Box 267, Santa Barbara, CA 93102). The program will take care of 500 tenants per diskette, do automatic billing each month, send out "nasty-grams" when the rent is overdue, generate tenant mailing lists and more. In addition, reports are generated for the apartment manager, apartment owner and the system handles the owner's trust account. $199 includes 2 diskettes and documentation (written in North Star Basic). Alpha Data will also be offering the software as part of a complete 32K system with printer and CRT.

Another significant program from Alpha Data is their Register/Inventory system. The system CRT/keyboard and printer is turned into a point of sale terminal (cash register) which works in conjunction with an inventory control program (over 900 items). I've seen it operating in a local computer store ... very impressive ($199).

Alpha Data Systems also offers a mailing list program which includes sorting and selection capabilities ($39.95) and an I/O control routine for the North Star DOS ($12.95).

Alpha Data's Register package consists of two diskettes; one with the programs and another with sample data. Inventory and cash register ... what a combination!

Whatsit?

This is the last one. I could go on forever because the list could go on forever! Whatsit is a home data management program that most people will find so enjoyable they'll want it in their office too! It's used for keeping track of things and people (their birthdays, hobbies, addresses, phone numbers, girlfriends, boyfriends ... you name it). It's worth a trip to your local computer store for a demo, okay? Available from Information Unlimited, 331 W. 75th Pl., Suite 2I, Merrillville, IN 46410. $75 for North Star diskette and documentation.

The BIG List

Leonard Garcia, 3517 Herschel Ave., Dallas, TX 75219, ran into a problem some time ago when he tried to get lists of North Star vendors from several user's groups. They didn't respond ... so he started making up his own list. He's done a fantastic job, especially when you consider your costs! Send him just a SASE and he'll fix you up with a list which has well over 65 suppliers and 685 programs!

Summary

The theme for this article has been the overabundance of software which can be run on a North Star disk-based system and/or Horizon. I could practically write another article on the hardware characteristics of the Horizon ... and I probably will. It certainly has enough features to warrant an article. In a nutshell, and at the risk of repeating myself, the most important thing about the Horizon is that it is a complete system ... assembled and tested. It all comes from one manufacturer ... and it works!

I think the various price configurations should be covered in another article, also. It would be interesting to see how the price of an assembled and tested 32K, dual-disk system would compare to buying the same thing in "bits & pieces." The cost would need to be computed for both hardware and time!

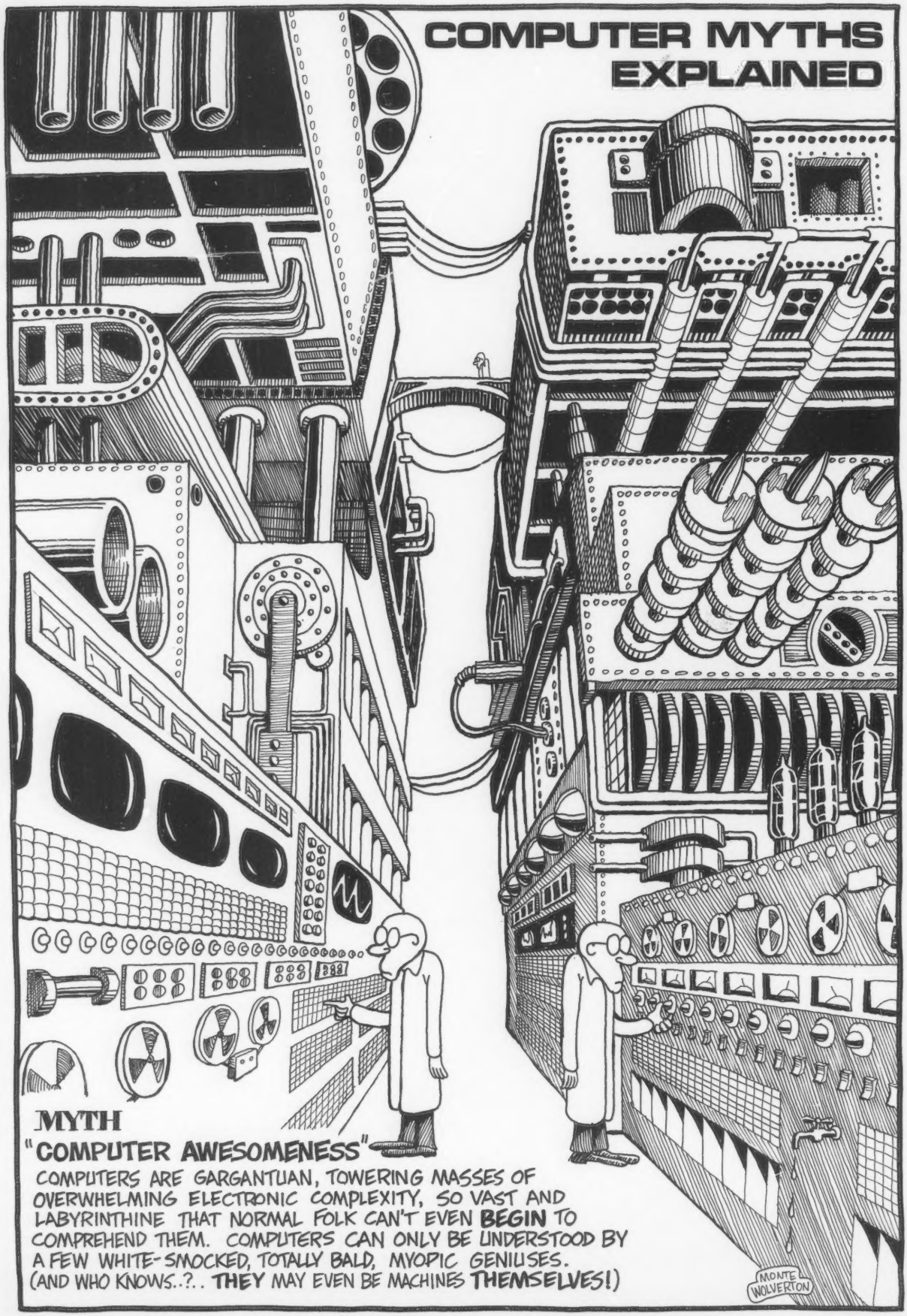
I'm sure North Star Computers would be happy to send you a copy of their latest catalog if you drop them a line:

North Star Computers
2547 Ninth St.
Berkeley, California 94710.

You might also want to drop a line to the North Star User's Group Program Library (still another source for North Star software!):

John Dvorak
Authorized NSUG Program
Library Distributor
704 Solano Avenue
Albany CA 94706

They have over 300 programs on 20 diskettes available for a small copying charge plus the cost of a new diskette. ■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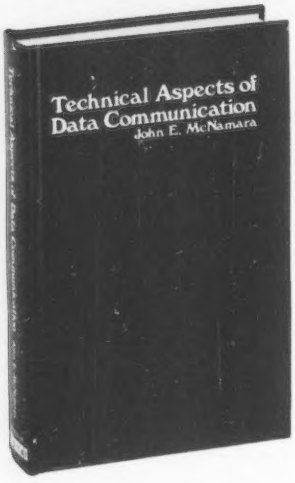

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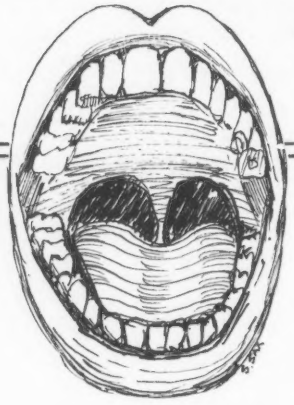

by John Sotos

Computers and acronyms have evolved together. The first computer acronym, ENIAC, was not very advanced, but progress in technology lead to rapid developments in acronymology, with such beauties as BASIC, MANIAC, and JOVIAL being the results. Since future directions in this field are bleak (HAL of *2001: A Space Odyssey* stood for Hueristically programmed ALgorithmic computer), an attempt is made below to stave off an Acronymal Dark Age (ADAGE). For each acronym an example of its use is also given.

Acronym	Meaning and Use
RABIES	RApidly Bought Interactive Educational Systems "Many colleges are afflicted with RABIES."
ALARM	**A** Language **A**ffording **R**isk **M**inimization "Dishonest programmers made us react with ALARM."
RUMP	**R**emote **U**ltramodern **M**ulti **P**rocessor "This terminal is connected to a RUMP."
SPUD	**S**ystem **P**rotection from **U**ndergraduate **D**eviousness — "SPUD is vital to system security."
SADISM	**S**uper **AD**vanced **I**nteractive **S**ystem **M**odule "SADISM was necessary when our competitor upgraded."
TURD	**T**horoughly **U**n **R**eadable **D**ocumentation "We were shipped TURD instead of user manuals." "TURD was included when we bought the computer."
TYPHUS	**TYP**ical **H**igh **U**se **S**ystem "Rapid communication is at the heart of a TYPHUS."
SS TITANIC	**S**olid **ST**ate **I**mplies **T**ough **A**nd **N**early **I**ndestructable **C**omputers "That SS TITANIC was never doubted."
CRAP	**CRA**sh **P**roof "Our system is CRAP."
TIPSY	**T**heoretically **I**m**P**ossible **SY**stem "A little TIPSY best describes his request."
DART-MOUTH	**DAR**ing **T**heoretical **M**ethods **O**f **U**ndergraduate **T**ime s**H**aring "Dartmouth has implemented DARTMOUTH."
MIRACLE	**MI**nor **R**epair **A**nd **CLE**aning "Only a MIRACLE can bring the system back up."

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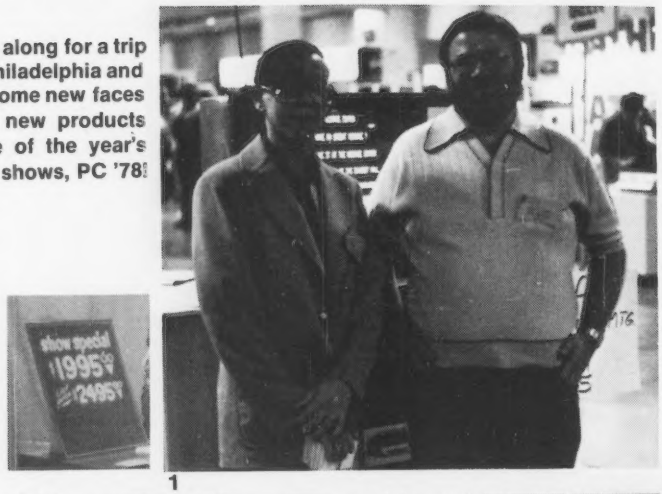
John Craig

Come along for a trip to Philadelphia and meet some new faces and new products at one of the year's biggest shows, PC '78!



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I sometimes feel that a good convention is like a shot in the arm to the personal computing industry. The manufacturers get a chance to get out and meet their customers (and get some worthwhile feedback), exchange ideas with fellow manufacturers, announce new products and a host of other benefits. And, of course, you and I get a chance to get out and see what's new first hand.

Personal Computing '78, held in Philadelphia over the weekend of August 25th thru 27th, was an overwhelming success! Unfortunately, all of us couldn't make it to the show . . . so I thought a few comments and pictures would be a way of sharing it with those of you who couldn't make it. I'll introduce you to some of the people in our industry . . . some new systems and peripherals . . . some fantastic software . . . and perhaps that miscellaneous item you've been looking for to add to your system.

#1 & #2

John Dilks, the bearded-wonder on the right, is the man behind PC '78. He, along with his friends, Dave Jones, (on the left) and Jim Main, have every right to be quite pleased and proud of what they've accomplished. It's kind of hard to imagine it, but there are actually displays and booths among all those people!

#3

Need a jukebox in your home? Well, maybe Newtech Computer Systems can help you out. They have a collection of 16 popular tunes available on North Star diskette, SWTP Miniflex, or SWTP AC-30 (diskettes — $19.95; tape — $15.95). The tunes are played through their Model 6 or 68 music boards ($59.95). 230 Clinton St., Brooklyn NY 11201.

NCE/CompuMart has the super Compucolor I system on display (which I believe is scheduled to be sold for $795 . . . includes a color monitor & mini-floppy drive). They also had a newcomer in the field up and running: the Interact Model One home computer. Consists of a keyboard and cassette drive mounted in a case along with an 8080A, 2K of ROM, 8 K of RAM ($499). They carry several other consumer systems, such as the Bally and PET, so maybe you oughta write off for their new catalog: 1250 No. Main St., Dept. CA8, PO Box 8610, Ann Arbor MI 48107.

'78

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#4

Without a doubt, one of the most practical application programs for a home system is a good data base/query system (although you probably won't appreciate the fact until after you've had one . . . and got used to using it). "Whatsit" is probably the only such package around for home systems . . . and is it fun! We've got a review of it coming up in Creative but if you can't wait, it can be ordered from Information Unlimited, 331 W. 75th Pl, Suite 2I, Merrillville IN 46410. North Star Diskette — $75; CP/M diskette — $125. (By the way, the developer of Whatsit is standing at the left: Lyall Morrill, Jr., of Computer Headware. Nice shot of that gentleman's back, don't you think?)

Ohio Scientific was showing off their new hard disk system, the C3-B (74 Megabytes!), along with the Challenger 1P and Superboard II . . . although they aren't exactly in the same class (the C3-B is over $12,000). The 1P comes enclosed in a case with keyboard, 8K Microsoft, Basic, KC cassette interface, 4K of RAM and more . . . for $349. The Superboard II is the "stripped" version, without the case . . . and goes for $279. 1333 S. Chillicothe Rd., Aurora OH 44202.

#5

The Computalker! Have you heard it lately? Dr. Lloyd Rice (2nd from left) gave me an impressive demonstration of his speech synthesizer speaking with a French and Spanish accent! Computalker Consultants, PO Box 1951, Santa Monica CA 90406. $395. (S-100, Apple, TRS-80 & PET Versions.)

#6

At the moment there are only two operating systems of any significance in the 8080/z80 world; Digital Research's CP/M and North Star's DOS. The brilliant folks at Lifeboat Associates (Tony Gold in the center, and Bonita Taylor on the left make up part of the crew) decided to put CP/M software on the smaller 5" North Star diskettes . . . and they've been selling like hotcakes! If you don't have CP/M and MicroSoft Extended Basic running on your North Star system, you don't know what you're missing! They have MicroSoft's Basic, Fortran and Cobol; Xitan's software; business applications packages from Structures Systems Group; and all of the CP/M software from Digital Research available on North Star or Micropolis Meta & MacroFloppy systems. 164 W. 83rd St., New York NY 10024. (Also inquire about the CP/M User's Group.)

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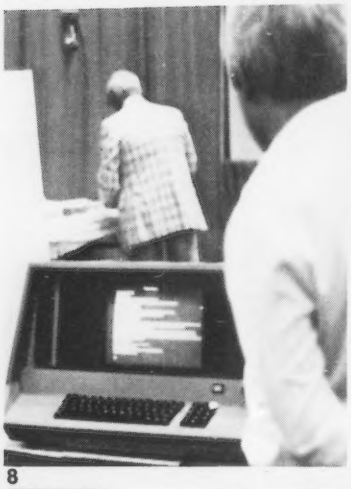

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#7 & #8

SD Sales has a couple of new entries into the market; a single-board, Z-80 based computer and their new SDS-100 small business system. The Z-80 Starter Kit looks like it would be ideal for teaching micros (priced at $249). It has, among other things, an on-board PROM programmer, Kansas City cassette interface and two S-100 connectors for expansion. The business system runs under CP/M which means there is a wide range of business applications software readily available. PO Box 28810, Dallas TX 75228.

#9

The University of Delaware was there with a demonstration of the Plato Project system. The system is a world-wide network dedicated to computer-based instruction and can also be used by the instructor for class management and student performance data. For further info: Delaware PLATO Project, University of Delaware, 46 E. Delaware Ave., Newark DE 19711.

#10

These two gentlemen (Stu Mitchell, famous author, on the left) look like they're closing up for the day. Actually, they're selling covers for your TRS-80 and PET ($9.95 & $16.95 respectively). International Technical Systems also offers an 8K PET expansion for $297. PO Box 264. Woodbridge VA 22194.

Heath had their new printer, the WH 14, at the show! Provides for selectable page width (132, 96, or 80 chars per line), page size and line width (6 or 8 lines per inch). See a demo at your local Heathkit Electronic Center . . . or drop them a line for more info: Heath Company, Dept. 355-450, Benton Harbon MI 49022. (You did know, didn't you, that Heath is now offering their systems assembled and tested?)

Take a minute and drop a line to Personal Software, PO Box 136-Z8, Cambridge MA 02138, and ask for a copy of the flyer describing their software packages for the TRS-80, Apple and PET (including a word processing system for the PET . . . which will be reviewed in an upcoming issue of Creative). They've also got a printer adapter for the PET!

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#11

International Data Systems had their impressive lineup of S-100 boards out on display. Perhaps their most famous is the 88-Modem Module and with computer networks gaining in popularity I'm sure they'll be selling more and more! Barbara Bagley, General Mgr., would love to send you a copy of their latest catalog: 400 N. Washington St., Suite 200, Falls Church VA 22046.

#12

CGRS has a 6502 based S-100 system (available in a variety of configurations), and more recently, a PET floppy disk interface which is also a complete S-100 mainframe. PO Box 368, Southampton PA 18966. (By the way, that's designer Joseph Swope in the center.)

The RCA VIP personal computer has recently come down in price (to $249 — assembled & tested) and at the show they announced several new boards for the system. These include a color expansion board (8 colors now!), expansion keypad for 2-player competition in games, 4K memory expansion and a Super Sound board for 4-octave music generation. RCA Cosmac VIP, New Holland Ave., Lancaster PA 17604.

#13

Notice the box sitting on top of the monitor cooking with the TRS-80? That little jewel from Microtronix will provide your TRS-80 with 2 joysticks, stereo sound and a parallel printer interface. They're also putting the finishing touches on a Pertec 8" floppy interface for running CP/M on the TRS-80. PO Box Q, Dept S, Philadelphia Pa 19105. (Check with Phil Aiken, the gentleman on the left.)

#14

If you Apple owners are in the market for a serial interface board then look to Electronic Systems ('cause they got one . . . which sells for $42 kit or $62 assembled). They also have a variety of components and S-100 boards, including the only S-100 Direct Memory Access board on the market (called TIDMA). Drop Bob Kushner, the president and gentleman behind the counter, a line and ask for their latest catalog: PO Box 21638, San Jose CA 95151.

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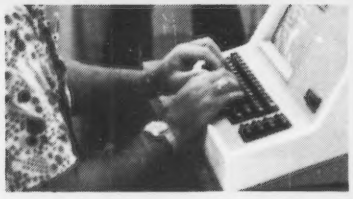

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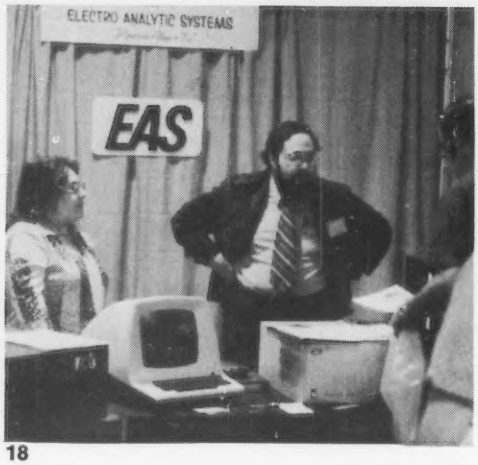

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#15

See that Horizon system sitting on the left? Would you believe that more software can be run on that computer than any other micro system on the market? (I'll discuss that in more detail in the review I've written on the system.) North Star Computers, 2547 Ninth St., Berkeley CA 94710.

#16

TSC, and it's distinguished president, Dave Shirk (2nd from the right), has developed a lot of significant software for the 6800 and recently taken off into "8080 Land" with those same programs. They're offering their tried-and-proved text editor/word processing system (as well as their inventory control package) on CP/M diskette now. Send off a quarter for their catalog, okay? Box 2574, W. Lafayette IN 47906.

Peter Jennings and Dan Fylstra of Micro-Ware Limited have, among other things, a new GraphicAdd package which adds bit-mapped graphics to your SOL or VDM-1 ($50) . . . comes with demo programs on SOL cassette, 27 Firstbrooke Rd., Toronto Canada M4E 2L2.

#17

Quite a crowd, huh? It didn't let up for the entire 4 days of the show, either! (And we certainly didn't mind!)

#18

Aha, would you look at this? **Another** CP/M system! (Seems to be catching on like wild-fire, doesn't it? I wonder how many of those "super-duper" 16-bitters coming on the scene will be running CP/M?) Electro Analytic Systems has the whole thing packaged in a nice wooden cabinet (two 8" Shugart drives. CP/M software and documentation) for $2495. PO Box 102, Ledgewood NJ 07852.

Watch out for United Software Applications! They've got some impressive applications and development software ready for shipment. Their OS/M Operating System is CP/M compatible and will support both standard-sized disk drives as well as the 5" minis. Future versions will include a multi-user capability. They have a Macro Assembler ($95), Text Editor called Daisy ($125 OS/M; $175 CP/M), word processing system ($300 OS/M and $350 CP/M), a North Star Basic-to-CP/M conversion ($40), Pilot, Payroll, CBasic, ADVENTURE!, Creative Computing's Games and more. 342 Columbus Avenue, Trenton NJ 08629.

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#19

Have you noticed what Eldon Berg has sitting in front of that PET? Yep, it's a standard ASCII keyboard for you touch typists! The whole interface is on a small PC board (installed without modification to the PET) and sells for $19.95. Provides upper & lower case and the PET keyboard remains functional. E. Berg Publications, 1360 SW 199th Ct., Aloha OR 97005.

#20

Have you seen the Sorcerer? It's a Z-80 based machine (like another popular consumer system) and has a standard ASCII keyboard (like another popular system doesn't). It has a full graphics character set with 512 x 240 resolution (which is very high, by the way). Stay tuned to Creative, folks . . . we've got some good stuff coming up on this one! That handsome gentleman in the middle is Paul Terrell, Exidy's Marketing Mgr. Exidy, Inc., 969 W. Maude Ave., Sunnyvale CA 94086.

#21

When it comes to big booths at computer shows, you're gonna have to go some to beat JADE COMPUTER PRODUCTS! They probably had 8 booths . . . but with all the systems, peripherals and boards they're offering these days, they need it! Don Smith, on the right, is the Main Man at Jade and he'd be happy to send you a copy of their latest catalog (if you can spare a couple of days to read it!). New address: 4901 W. Rosecrans, Hawthorne CA 90250.

#22

According to a recent readership survey most of us are interested in reading about, and buying, peripherals . . . especially printers. The Qume and Diablo printers possibly provide the very best in word processing quality. Ken Widelitz (on the left) would like to hear from you if you're in the market for one. COMPUTER TEXTile, 10960 Wilshire Blvd., Suite 1504, Los Angeles CA 90024.

#23

"The Lawyer's Computer" is what the folks at Professional Business Computers call their system. With Document Processing, Time Accounting, General Account & Trust Account systems, along with Accounts Receivable, it looks like they're right! 528 Pine Song Lane, Suite 202, Virginia Beach VA 23451.

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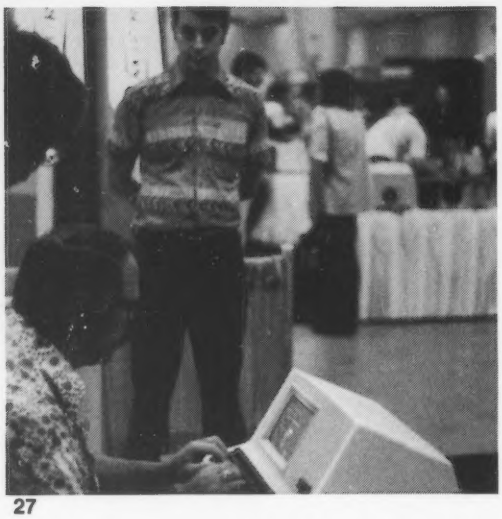

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#24

Processor Technology has a new word processing system which runs under PTDOS (Helios disk system). It's called the Word Wizard and it will be offered with two printers, the SOLPrinter II (impact metal) and SOLPrinter III (dot matrix). Get on down to your local dealer and take a look at it, okay? 7100 Johnson Industrial Dr., Pleasanton CA 94566.

#25

Here's an exciting one! The extinguished-looking visitor to this booth (on the left) is none other than Merl Miller (President of Matrix Publishing). He's playing with the Rockwell AIM 65 microcomputer system . . . and I do mean system! The little beast comes with a keyboard, twenty 16-segment displays (alphanumeric!), 20 character-wide printer, 6502 processor, 1K of RAM and a 4K monitor which includes an assembler and mini-editor . . . and more. Sells for $375 and should be available with Basic in PROM in the near future. Robert Tripp, on the right, is publisher of MICRO, The 6502 Journal, and he'll be happy to talk to you about the AIM and other 6502 products he offers through The Computerist, Inc., 56 Central Square, Chelmsford MA 01824.

#26

Imsai's new series of dual-floppy systems, the PCS-40, 42 & 44, were attracting more than their share of the crowds. The systems range from 180 to 780 Kbytes, respectively . . . and from $2695 to $3695 in price (32K RAM, I/O, and 8085 processor). Imsai Mfg. Corp., 14860 Wicks Blvd., San Leandro CA 94577. (Alan Rosenblaum, the dapper gentleman in the center and Imsai's Marketing Mgr., would be happy to fix you up with a flyer on the PCS-4X series.)

#27

No, that's not the bouncer standing there . . . it's John Deres, one of Southwest Technical Product's sharp engineers. Just how sharp will become evident when you sit down at their new CT-82 terminal! It's fantastic! In addition to being a very good-looking terminal it has a Cherry (TM) keyboard that comes as close to feeling sensuous as any keyboard could! Sells for $795 and has too many features to list here. The terminal is also sold with SWTP's System B which includes dual standard-sized floppies (1.2 Megabytes!), 40K RAM, DOS & Basic . . . all enclosed in a beautiful desk . . . for $4,495! Try to top that! 219 W. Rhapsody, San Antonio TX 78216. (We'll have a review of the CT-82 coming up . . . soon.)

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Smart Electronic Games and Video Games

David H. Ahl

In this year's crop of games you'll find more versatility, more choice, and more smarts for less money.

After the Toy Fair last February, it was obvious that the biggest growth category in the toys and games industry in 1978 would be in electronic and video games. Now that the prototypes that were shown last February are on the store shelves, it's time to do our annual round up of the new, the old, the good and the mediocre.

Many of the games below were reviewed in depth on our pages during 1977 and 1978. In those cases the issue and page number are noted at the end of the capsule description. Other games without an issue noted were tested only briefly for this round up.

In still other cases, we only saw the prototypes and can't vouch that the production models on store shelves will live up to the starry-eyed claims made last February at the Toy Fair or in June at the Consumer Electronics Show. These are identified by **"NT"** (Not Tested) following the name of the game.

No round up like this is ever complete. In some cases we deliberately left out a game (saying nothing at all was the nicest thing we could do with some new entries). In other cases, we just weren't aware that the product existed and/or information arrived after presstime.

In any event, shop around for variety and price. And try things out before you buy to make sure it will hold your interest or the interest of the person for whom it's a gift.

Manual Games

Zone X

Will Invicta ever give us a chance to recoupe (from Master Mind) before they bring out another challenging logic game? Zone X, their newest addition, is an interesting derivation of the Master Mind premise. The zone-breaker uses a pegboard to guess the target point set by the zonemaker on his marker grid. This is not an easy game!

Zone X, complete with searchboard, marker grid, pegs, marker, and eraser.

(A $25 bonus goes to the author of the best computer version of Zone X received by March 1, 1979 in addition to the normal game/article payment. Send listing, run, description and SASE. How about a graphics version for the Apple, TRS-80, or PET?)

Press Ups

Another Invicta game which we got in England some time ago but is finally available in the U.S., Press Ups is a fast-moving logic game. Each player has ten colored pegs, five at each side of the 7 x 7 board. Yellow pegs in the rest of the board are neutral. Players take turns pressing down one peg which must be adjacent to a previouly pressed peg trying, on each move, to guide the direction of play toward his colored pegs.

[Did you ever wonder who those exotic models are on the Invicta boxes? You guessed it — they're all Invicta employees in the various plants. — DHA]

(Yet another $25 bonus for the best computer version of Press Ups received by March 1, 1979!)

Super Master Mind

Super Master Mind is a step above Master Mind as it has 8 different colors (Master Mind has only 5). Speedy

computer calculations indicate there are over 59,000 possible answer combinations (according to Invicta, I only came up with 40,320, but I was never much of a mathematician). To add to the challenge, leave an empty space in the "answer code" and watch what happens (you go bananas!).

Grand Master Mind

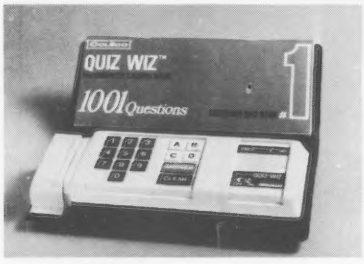
A game like Grand Master Mind is enough to make you swear off Master Mind games forever, or perhaps become permanently addicted. If you've played previous Master Mind games and thought them difficult, try this one. You are allowed 10 tries to guess the colors, and for a new twist, you also guess shapes. Master Mind aficionados will find this a welcomed addition to their collection.

Smart Electronic Games

Coleco Amaze-A-Tron

This clever little maze game may be played alone or with a partner. The computer gives a starting and finishing point on a 25-square grid. You move a plastic marker and try to find the correct path from start to finish. A short musical tune plays when you hit a correct square; a wrong move gets a "raspberry" sound. It takes a few plays to get the hang of it, but once you do, it's addictive. The tunes are pleasant and plenty loud to be heard in a noisy room of kids. "Solitaire Maze" is simple enough for a 6-year old, "Blind Alley — Back to Start" is a challenge to an adult.

Blue and white plastic case 4½ x 6¾ x 1½ in. Uses one 9-volt battery. Retail approx. $23.



Coleco Quiz Wiz

Quiz Wiz is a small electronic device which stores the answers to 1001 multiple choice questions. Armed with a booklet of 1001 questions (there are seven such books on subjects like sports, people, history, television, music and books, mathematics and trivia) you punch in the question number and your answer. Quiz Wiz gives you a green light and high tone if you're correct, a red light and low tone if you're not. We found the tones barely audible in a moderately noisy room so you have to watch the lights. To some adults it seemed like too much button pushing, but kids loved it. Ages 6 and up.

Maroon vinyl binder/case, 9½ x 4 x 1½ in. Uses one 9-volt battery. Retail approx. $20. Quiz booklets $3.

Coleco Digits

Yet another electronic Bagels/Master Mind similar to Milton-Bradley's Comp IV (except Digits only uses 4-digit mystery numbers). Two skill levels.

White plastic 6 x 4 x 1½ in. Uses one 9-volt battery. Retail approx. $18.

Milton Bradley Simon

Simon, a computer update of the age old game, Simon-Says, is, without a doubt, one of the best party games to hit the market this year. It is a large disc with four different color plates. Simon lights up the plates and you follow his lead by playing back the proper color and sound sequence. The music is loud enough to hear at parties and the lights bright enough for inside use. Three different solitaire and multi-player games and four skill levels make Simon suitable for Age 5 to adult. One possible drawback: the plates aren't bright enough for outside use or in the car (which would be a great way to keep the kids busy while driving on vacation.) However, this drawback is minor if you learn the music associated with each color.

White and colored plastic, 12 in. dia. Uses two D cells and one 9-volt battery. Retail approx. $25.

Dice.

No. 29R1861 Bone Dice. Square corners. No. 6, size, ⅝-inch.
Per dozen..... .....9c

If by mail, postage extra, per dozen, 3 cents.

Milton Bradley Star Bird

When Star Bird first flew into the office, most females disliked the Star Wars-style craft, while the males praised it. Having had it in several different environments, this male/female reaction still seems consistant.

A microprocessor detects the attitude of the hand-held plastic plane (climbing, level, or diving) and simulates appropriate engine speeds. It also "fires" lasers with a "realistic" zap sound accompanied by blinking lights.

Various parts detach (escape pods, interceptors, high-speed fighter) and could break in impatient hands, although it is as rugged as any other plastic toy. The Raggedy Ann/Andy school of "kids-make-their-own-fantasy" school of purists won't like Star Bird; most kids (and their fathers) will love it.

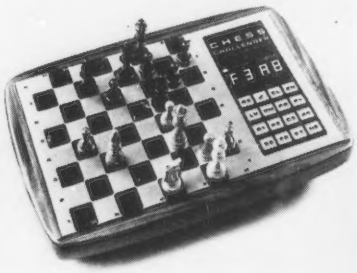
Gray plastic with colorful markings, 15 in. long. Uses one 9-volt battery. Retail approx. $15 to $20.

Boris

In this electronic chess game, the amount of time the computer has to process its possible moves is set by the player. Up to 100 hours can be allowed but several seconds is enough to give a challenging game. The pieces, small board, and computer with keyboard and LED readout fit in a walnut box with lid. Boris comments on players' moves via phrases traveling across the LED display. **Boris Master** operates on rechargable batteries and has a memory feature. Suggested retail prices: Boris $299, Boris Master $399. **Boris** is distributed by Chafitz, Inc., 1055 First Street, Rockville, Maryland, 20850.

Chess Challenger X

This is the latest computerized chess game of Fidelity Electronics. The X means ten levels of play where one level roughly corresponds to the microcomputer looking ahead one-half move. Level one requires a few seconds, while level ten requires around several hours for a move. The board is part of the unit while the LED displays and touch pad keyboard are on the side. Features include a beep when its move is complete, and a random choice between moves that are judged to be nearly equal in value. Suggested retail price is $275.



TI Speak & Spell

Electronic voice pronounces over 200 words, you key in the spelling. It announces when you are right or wrong and displays your score. Games like "Mystery Word" and "Secret Code" add to the fun of learning to spell.

Red plastic, 6½ x 10 x 1½. Uses 4 C-cells. $50. (Sept./Oct. '78, pp 60-61).

TI Spelling Bee

Non-speaking version of Speak & Spell. Comes complete with picture book and fold-up case. Uses 9-volt battery. $30. (Sept./Oct. '78, pp 60-61).

Arithmetic Practice Calculators

Seven of these little calculators are on the market this year, some with built-in games (Dataman), some which keep track of number correct and also display correct answers (Little Professor, Quiz Kid II), and others that only light up a green or red LED in the case of a correct or incorrect answer. All use one 9-volt battery. Prices from $8 to $25.

Mattel Auto Race, Football, Missile Attack

In all three games you control a bright light blip which represents your car, player or missile. Computer controlled blips are coming toward you (or you are moving toward them) and you are trying to avoid a collision (in Auto Race) or being tackled (in Football), or you are trying to shoot down enemy missiles. We liked Football best and Missile Attack least. For 1978, Missile Attack has been renamed "Battlestar Galactica Space Alert" perhaps hoping that the new TV show will stimulate sales. Also "Basketball" has been added to the lineup but we've not had a chance to try it.

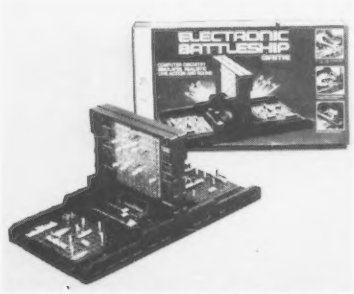
All come in a handheld plastic case and use one 9-volt battery. Retail range $18-$35. (Jan./Feb. '78, pp 27-29).

Milton Bradley Comp IV

Use the calculator pad to guess a secret 3, 4, or 5-digit number. Comp IV gives you clues (how many digits correct and how many in the correct

position). A game with lasting interest.

Plastic console 7½ x 4 x 4 in. Uses one 9-volt battery. Retail range $20 to $40. (Nov./Dec. '77, pp 36-37).



Milton Bradley Electronic Battleship

An electronic version of the manual Battleship game. The electronics mainly provide zippy sound effects. Retail range $30-$50. (May/June '78, pp 47-48).

APF Mathemagician

A teaching calculator which can be "programmed" to provide arithmetic problems on almost any level of difficulty. Mathemagician also has six built-in games which can be played using different plastic overlays. The large size and bright display make it ideal for younger children. Uses 6 C-cells. Retail $39.95. (Mar./Apr. '78, pp 92-94).

T.E.A.M.M.A.T.E. Game Computer

This device is a battery-operated device with a microprocessor, limited memory, 4 x 4 lamp display, 16 key keyboard, and speaker. It comes complete with 25 simple programs in memory which can be "called" by pressing the appropriate keys on the keyboard. Each program is described in the very complete manual. The "programs" are in a low-level logic rather different than either Basic or machine language. The output is all through the 4 x 4 lamp display which uses a different slide overlay for each one. Blank overlays are also included so you can write your own.

The second chapter (12 pages) of the manual is an introduction to binary and hexadecimal number systems, computer organization, and elements of a large-scale computer system.

Uses 4 D batteries (which we found should be akaline or extra duty). From Logix Enterprises. Retail $40-$50.

Parker Brothers P.E.G.S.

15 chase and maze games played by inserting pegs into a double-sided electronic board. Makes sound when two pegs are in the same hole on opposite sides of the grid. Sounds innocent enough but once you start playing it begins to get wild! Although aimed at children from 7 to 14, adults had a ball playing "Battle of the Blobs" and "Hostage." Plastic. Uses one 9-volt battery. $15.

Parker Brothers Merlin

Plays 6 games (Tic Tac Toe, Music Machine, Echo, Magic Square, Mindbender, Blackjack 13) with 9 levels of difficulty. We enjoyed "Echo" immensely, trying to echo Merlin's tunes — no one here could echo more than 7 notes correctly. "Magic Square" was quite a challenge also, particularly the "challenge version for experts only." Eleven touch keys; red plastic. Uses 6 AA batteries. $25.

Invicta Electronic Mastermind (NT)

Break the hidden 3, 4, or 5 digit code in this electronic version of Mastermind. LED display tells how many digits are correct and in right position. Handheld. Uses 2 AA batteries. $20.

Video Games

Bally Professional Arcade

Outstanding graphics, 256 colors, nifty 3-function controllers and a nice assortment of game cartridges make this a system well worth considering as a video game system. However, for an extra $50 Bally offers a programming package that includes a Basic cartridge and an excellent printed introduction to the language that does not presume any previous computer experience. The Audio Cassette interface for another $50 allows you to use a standard cassette recorder to save and retrive programs. The ease of using the color, graphics and music (built-in 3-octave music synthesizer) is remarkable, though you probably won't be able to match the complexity of professionally prepared programs. $299. (Sep./Oct. '78, pp 56-59).

Atari Video Pinball

Plays four pinball-type games, two with flippers and two with a moving paddle at the bottom of the screen.

Also two basketball-type games and the incredibly popular Breakout in which you move your paddle to hit a ball to break away six colored walls of bricks at the top of the screen. Fun for the beginner, challenging for the expert. Extremely addictive. Uses 6 C-cells or AC adapter. Retail $55-$75. (Jul./Aug. '78, pp 35-36).

Atari Video Computer System

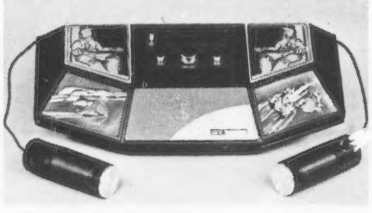
Perhaps the most comprehensive programmable game playing video system around, this unit has two skill levels, four types of controllers and an enormous library of games. Twenty game cartridges are currently available including Breakout, Indy 500, Blackjack, Starship (maneuver through space), Surround (lay down a maze with an opponent without getting trapped), Air/Sea Battle (planes dropping bomps, submarines launching missiles, shooting gallery), Outlaw, Home Run, Slot Racers, and, of course, Video Olympics (50 Pong-type games and variations). Most cartridges contain 3 to 6 fundamentally different games and 6 to 8 variations of each one.

Retail $165-$200. Cartridges $19 each. (Jul./Aug. '78, pp 37-39).

Fairchild Channel F System II (NT)

A redesigned version of the original Channel F, this has four difficulty levels, four time limits, and a unique "freeze" switch which permits interruption of a game with play resumed later (nice if you want to watch TV and play during commercials — or vice-versa). The unique controllers, which we found a bit difficult to get used to, turn, twist, push and pull in eight different ways. Three game cartridges use a numeric keypad controller (Poker, Football and a lunar lander game). Twenty-one other cartridges are availale over a wide range of subjects, some with as many as 284 variations.

Retail $125-$150. Cartridges $20 each.



APF Model 500 (NT)

A dedicated video unit with 20 space games including Space War, Space Phasor, Phantom War (invisible space ships) and more. Guided or direct missiles.

Video Sport, TCR-900 PC (NT)

Yet another entry in the programmable price race ($69). This, like the last three products, will probably appear under various private label and store brand names.

Radofin Telesports III (NT)

A Hong Kong entry, Telesports is a low-price ($69 retail) programmable. Comes with 2 joysticks. Seven game cartridges planned with up to 10 games each.

Otron Gamatic 8600 (NT)

Another low price ($69) programmable with two joysticks. Four cartridges as of August. From Korea.

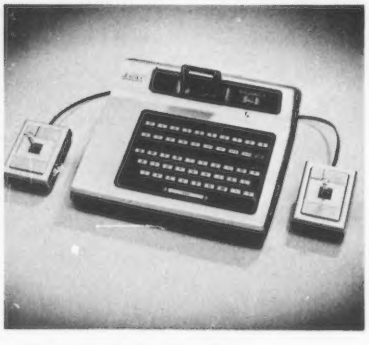
Video Technology Model 501 and Model 2003 (NT)

Two programmable entries in the low price derby (below $70). The 501 is a basic programmable while the 2003 has extended capabilities similar to Video Brain and also high resolution (256 x 256 pixels).

Coleco Telstar Arcade

Of the programmable video games, this is certainly the most tactile. No little knob to steer your racer, but a good size steering wheel and gear shift. And for the target games, a full-size (plastic) pistol. Two remote controls included in the price of the sports cartridge supplement the two built-in ones and allow for four-player competition. Two-level skill control.

Triangular plastic housing approx. 15" on a side. Comes with AC adapter. Bargain priced at $65; cartridges $10 to $15.



Magnavox Odyssey (NT)

Video system featuring a touch-sensitive alphanumeric keyboard as well as the usual joysticks. The keyboard and "computer introduction" cartridge indicate that Magnavox is looking ahead toward a truly programmable computer on the order of the Bally Arcade; but this is still only a game system. Around $180. ■

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Parody of *Datamation*, Business Computing: 5 inventory control systems, ABCs of microcomputers, structured software for micros, four computer music systems, reviews of 2 Basic interpreters and micro-APL, CAI-Part 4, puzzles and games.

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Art and animation section: 8 articles, color graphics, SAM76, binary search, a real budget in Basic, business computing: 4 payroll systems, Oregon Trail, Black Box, reviews of VideoBrain, MSI floppy, OSI Challenger, Ai speech synthesizer.

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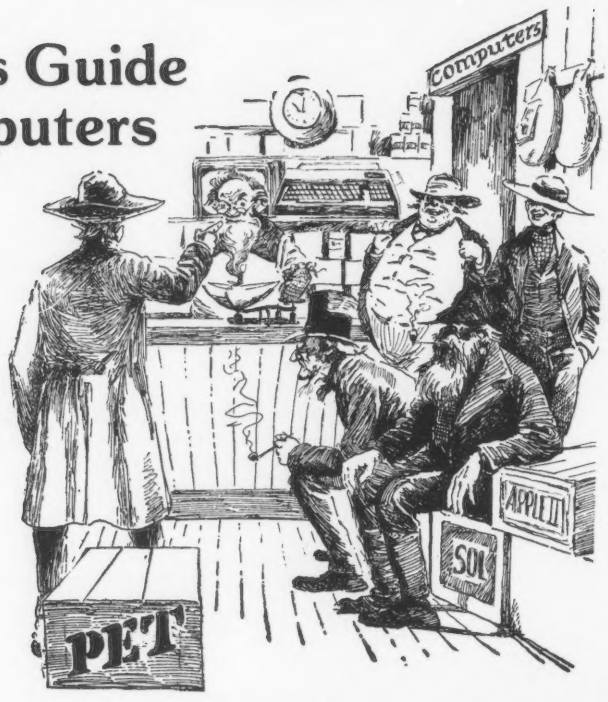
First Annual Buyer's Guide to Consumer Computers

Steve North



Within recent months, a number of consumer electronic firms as well as some of the established microcomputer manufacturers have introduced completely assembled microcomputer systems which can be used by almost anyone. To help you decide which system may best fit your needs, we present here a short comparison of most of the consumer systems. (One suspects that "consumer computer" is about to become one of the most overused phrases in the English language.) Some subjective comments are also included — please don't send parcels of dead fish to the reviewer if you don't agree! Products which have only appeared in a manufacturer's press releases and other pipe dreams are not covered here.

Processor Technology's Sol System was one of the first of the all-in-one computers that don't require connection to a separate (and usually costly) terminal. A single typewriter-sized cabinet contains the CPU and memory, a video interface (with upper/lower case, reverse video and some graphics characters), keyboard and audio cassette interface. You add your own TV set and cassette recorder. The Sol uses the S-100 bus, so you can add up to 64K of memory and plug in any of the widely varied S-100 bus cards. Processor Technology has two BASICs, PILOT, and a FORTRAN compiler which will be out soon. The Sol has been around for quite a while and Processor Tech has a good reputation for supporting its systems through an excellent dealer network. One disadvantage of the Sol is that BASIC is not built-in (in ROM) but must be loaded from cassette tape. On the other hand, this is not much of a problem if you don't want to be stuck with just one BASIC, or if you can afford a disk. In brief, Sol systems are high-quality but, remember that you do have to pay. A minimal Sol is priced at $2095 with 16K of memory, while the top-of-the-line unit with four very fast full-sized floppy disk drives and 64K comes in at $8,750.

The Complete PET incorporates absolutely *everything* a good computer needs, even the TV monitor and cassette recorder. Microsoft BASIC (more or less a standard in its own right) is built-in and available as soon as you turn the computer on. The PET has the unusual ability to display either upper/lower case, or upper case and a full set of special graphics characters (such as card suits, little boxes and circles, etc.). The video is fast enough to allow animated graphics with these characters. Based on these qualifications, the PET would be an extremely outstanding machine, but there are also some very bad problems. First, the PET has the worst excuse for documentation we've ever seen. This void is partially filled by a number of very active user's groups, who can tell you many of the things Commodore should have in the first place. Second, the PET can't be expanded beyond 8K of memory without using a non-Commodore attachment. Finally, the PET's calculator-style keyboard is ridiculous, maybe one of the worst engineering mistakes in the history of personal computing, although, as many PET owners testify, "you get used to it." Commodore has also announced a PET Printer, an auxiliary cassette unit, and perhaps later they'll have a floppy disk option. While Commodore has been dragging its corporate heels on these peripherals, other companies are second-sourcing PET peripherals and memory, though not with the same variety as S-100 bus products. The standard 8K PET costs $795.

Radio Shack's TRS-80 consists of a keyboard/CPU unit, a video monitor and an audio cassette recorder. The keyboard/CPU unit can contain 4K or 16K of memory, and either Level I or Level II BASIC. Level I BASIC is essentially Palo Alto Tiny BASIC beefed up with floating-point math, while Level II is the ubiquitous Microsoft Extended BASIC. Rumor has it that Level I will be phased out or at least de-emphasized in the future, in favor of the superior Level II BASIC. Both machines are restricted to displaying upper case only, and plotting points on a coarse 128 by 48 grid, certainly not as fun as the PET or Apple. If you want more than 16K of memory or plan to add any peripherals, then you'll need the expansion interface, which contains another 16K of memory, and the hardware needed to connect floppy disk drives and a line printer. The cassette interface in Level I BASIC runs at 250 baud (agonizingly slow) while the 500 baud Level II cassette is not nearly as reliable. The TRS-80 really isn't outstanding in any way, but it is a big seller because it's one of the cheapest ways to get your hands on a BASIC-speaking machine, and because Radio Shack has a marketing and distribution system unequaled by any other micro manufacturer. The cheapie Level I 4K machine is $599, a Level II machine with 16K of memory is $999.

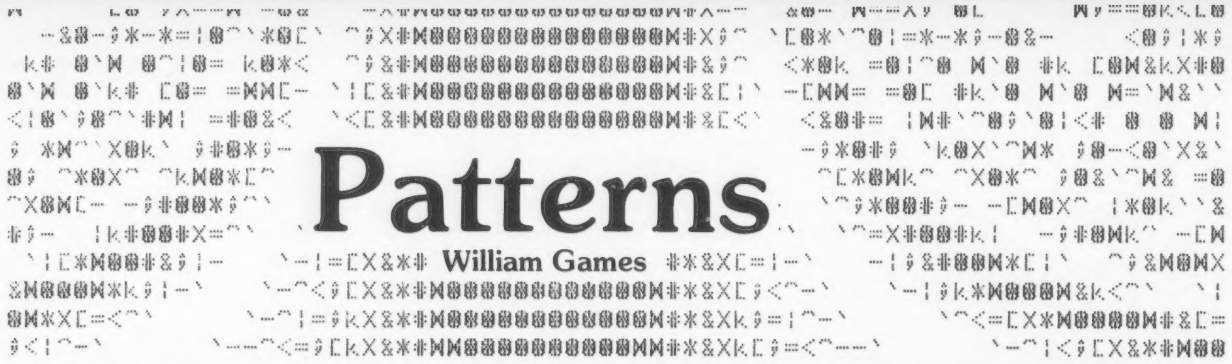
The Apple II is best known for its impressive color graphics. Like the Sol, the Apple requires connection to a TV set and a tape recorder. Two game paddles are also included. Color graphics may be done in a low-resolution mode (40 by 40, with 16 colors), or in high-resolution (160 by 280, with 4 colors). Text and color graphics may be split on the same screen. (Text unfortunately is upper-case only.) The Apple has built-in integer BASIC with special features for accessing the graphics and game paddles, besides some neat debugging aids and a machine-language monitor. Floating-point Applesoft (Microsoft) BASIC is also available. You can add up to 48K of memory to your system, simply by buying the memory chips and plugging them into sockets in the Apple. Options for the Apple include interface cards for a printer and for data communications, and a floppy disk unit (though the floppy disk drives are very hard to get ahold of now). The Apple is a fun and versatile machine. A 16K Apple is $1,195.

The Exidy Sorcerer is one of the most recent entries into the consumer market, and it seems to incorporate many of the best features of its competitors. Like the TRS-80, the Sorcerer consists of a keyboard/CPU unit, a video monitor and a cassette recorder. But there are several innovations worth noting. First, the Sorcerer has a slot in the side for a removable ROM-PAC cartridge, which contains the system software you want to work in. No other system has this capability. Second, the Sorcerer display has upper/lower case, PET-style graphics characters, *and* user-defined graphics characters (which you create by setting up the correct bit-patterns in memory). The Sorcerer comes with a Microsoft Extended BASIC ROM-PAC, but others (for APL, FORTRAN, and word processing are supposedly on the way). Third, an S-100 bus expansion unit with 8 slots may be added. Exidy is also planning on a color-graphics option for the Sorcerer, and it looks like their Disk Operating System will be the powerful and widely used CP/M. The price tag is also very easy to take - $895 for the basic unit with 8K of RAM.

The Bally Video Arcade is mainly a video games machine, but by adding a $50 game cartridge, you can have a BASIC-speaking computer, which allows you to write and execute BASIC programs including music and color graphics. Bally BASIC is really Palo Alto Tiny BASIC in disguise, so it's very easy to learn. The Bally Video Arcade must be programmed through a calculator keypad (the ultimate form of the PET-style keyboard) by using multiple keystrokes to enter a single character or BASIC keyword. Certainly not for anyone who wants to get into any heavy programming, but when you get tired of BASIC there's always gunfight for two players. The Video Arcade is $300, add $50 for the BASIC cartridge.

Ohio Scientific's Challenger II includes a CPU, 4K RAM, keyboard and video display (with upper/lower case and some graphics characters) in one unit. A video monitor and cassette recorder must be added. The Challenger has Microsoft 8K BASIC and a machine-language monitor contained in ROM. Additional memory and floppy disk drives may be plugged in. Probably the Challenger is not as popular as it might be because the cabinet is not that slick-looking, and Ohio Scientific does not have an extensive dealer network (at least in our area of the country). Prices start at $598.

Others. Several of the *real* biggies are threatening to get into the act, most prominently, Texas Instruments. (The wildest rumor I heard concerning TI has them linked with, yes, IBM. Their 9940 based system will feature IBM's favorite language and an externally attached bubble memory module which will use a patented connector. Of course, if IBM did want to do something with TI, they would probably just *buy* TI, but then I did say it was a *wild* rumor.) Another interesting thought: the "Japanese Invasion" is already underway. Where will this leave the American manufacturers in a few years? There is some difference between slapping together a PC board and providing extensive support for a technically sophisticated product, but it's not hard to buy a disk operating system, or BASIC, either. ■



Patterns

William Games

Patterns in nature are aesthetically pleasing as well as a key to understanding processes and events. So it is with functions of two variables. They, too, may exhibit wondrous patterns and symmetries that help one appreciate the order and beauty of mathematics. Here is a program that generates contour maps of two-variable functions over domains of the user's choice. The results can be both beautiful and educational.

When one first inspects the function z=cos(xy), he is probably left cold. A question that first arises might be, "What does it look like?" The function can be analyzed for critical points. Points can be evaluated and plotted. Only after much time, abstract imagination, and artistic effort, may that object of one's curiosity be seen. Unfortunately, many of us do not have such mathematical training or the perseverence to behold such sublime splendor. It is for the impatient and the lazy that computerized graphics are so useful. Unfortunately, though, the cost of graphics systems and terminals are well above the means of most hobbyists and schools. Let us improvise, using BASIC, the ASCII character set, and a Teletype-like printer.

Our objective is to graphically represent functions of two variables such as z=cos(xy). Mathematically, this involves plotting in space a function whose domain is a subset of the xy-plane. In other words, the ordered pair (x,y) is mapped onto z=f(x,y). If f(x,y) is continuous, the result is a "surface" suspended in space where each point is of the form (x,y, f (x,y)).

The best way to "see" these functions or any surface on a two-dimensional piece of paper is with a contour map. In the case of many contour maps, equal elevations are represented by a continuous curve through those points. Another approach is to color or shade the map according to elevation. It is the second technique that is used in this program. Since there is the constraint of the discontinuous Teletype, equal elevations, or values of the function, must be represented by ASCII characters. In this program, the greater the value of the function, the more dense (darker) the combination of characters printed. When viewed very closely, such output makes little sense. When viewed as a whole, though, the discontinuities tend to blend together creating the overall affect of gradual darkening of greater and greater values of the function and thus the curvature of the surface itself.

The following program is an efficient tool for "seeing" what functions of two variables look like and/or creating beautiful patterns. The program is designed to allow easy manipulation of parameters for discovery of their effect on the whole. To change functional parameters or the function itself, simply redefine the function in line 110. Upon execution, the program is designed to first interrogate the user. The user is asked to specify the domain of interest, first the x-axis interval and then the y-axis interval. In effect, a rectangular area of the xy-plane is defined for plotting. It is recommended that the intervals be the same length to minimize scale distortion. Once the domain of interest is specified, the user specifies the number of pages of output. A response of one results in exactly the specified domain being printed. A response less than or greater than one results in a corresponding fraction or multiple of the original domain being printed. Initially, a response of one page is recommended. Next, the user is questioned whether or not to automatically compute the range of the function. Since the function in line 210 defines a linear one-to-one correspondence between the range and all characters in A$ and B$, accuracy in specifying the range is important. A NO response to the query allows the user to input the range. To the YES response, the program responds by automatically searching all plottable points for the absolute minimum and maximum values. Finding the range automatically may take more than a few seconds. Note that the range (R1, R2) is widened at both ends by .00001 to compensate for round-off errors.

Once all parameters are set, the output phase begins. Simply, the output section consists of a horizontal printing loop nested in a vertical advancement loop. The inner x-loop is responsible for the printing of a single line representing the value of the function across the entire x-interval for a fixed-y. The x-loop is incremented by the length of the interval divided by the number of print positions. Thus, a greater number of print positions per fixed interval increases the sense of continuity. The function defined in line 210 converts the numeric value of the function in line 110 into a position on A$ and B$. These strings list the output characters arranged by increasing density. Note that each line is printed twice. First, the determined position in A$ is output in each print position. The carriage is returned to the beginning of the same line where characters from B$ are then printed. By printing each line twice, the range of discrete densities is increased. The result is a smoother surface in appearance. In effect, each position (P) returned by the function in line 210 is graphically represented by the "sum" of the given position in A$ and B$. The characters assigned to A$ and B$ give the best result for a Decwriter II terminal. Modification of the character strings may be necessary for other terminals. If one is working with a CRT, or desires only one sweep of each line, then change line 60 to read: 60 N=1 (n is the number of sweeps of a given line). The I-loop determines the number of times each line is printed and is controlled by the assignment in line 60. The Y-loop sweeps the domain one line at a time, beginning with the greatest value of y. The Y-loop is stepped by the same increment used in the X-loop. A scale factor is introduced to compensate for discrepancies in the number of columns and lines per inch. It is assumed that 10 columns=6 rows=1 inch. After a map has been printed, one may want to repeat the map but extended above and below. This may be achieved by responding to the page prompt with a number greater than one. By increasing the number of pages to two, the length of the Y-interval will be doubled as will the length of the output. Changing this parameter has no effect on the scale or output of the initial domain. Caution should be exercised here as the original range may be exceeded. Whenever the value of the function is outside the specified range, the letter E prints to indicate the error. Repeat the program with widened range when this happens. ■

William Games, 8357 Alexe Ct., Stockton, CA 95209.

Experimental Functions and Activities

Try these functions for interesting results:

1. cos(x)*sin (y)
2. cos(x)+cos(y)
3. exp(sqr(x↑2+y↑2))-int(exp(sqr(x↑2+y↑2)))
4. cos(x*y/sqr(x↑2+y↑2))
5. cos((x+y)/(log(abs(x*y)+.5)))
6. cos((abs(x)+.5)↑y)
7. cos(y/(abs(x)+.5))
8. sin(x-y)/(1.5+cos(y))

An interesting assignment for high-school students might be to investigate the effect of manipulating constants in arguments. For example, how is the map of cos(x)*sin(y) transformed when the function is changed to cos(x)*sin(2*y) ? Another inquiry might illustrate various trigonometric identities. An example is sin(x+y)=sin(x)*cos(y)+cos(x)*sin(y).

Six Sample Patterns from the program will be found on the next two pages.

Table of Program Variables

A$:	output characters ordered by increasing density
B$:	output characters for second sweep
E$:	error indicator
L:	the number of characters in A$
N:	the number of times each line is printed
W:	width or number of print columns
X1,X2:	domain interval (X1, X2) along x-axis
Y1,Y2:	domain interval (Y1, Y2) along y-axis
X$:	dummy string
R1,R2:	range of FNZ (X, Y)
X, Y:	the coordinates (X, Y) being printed

```
1  REM ************************************************************************
2  REM ***                                                          12/26/77  ***
3  REM ***    WRITTEN BY: BILL GAMES                                          ***
4  REM ***                8357 ALEXA CT.                                      ***
5  REM ***                STOCKTON, CALIFORNIA    95209                       ***
6  REM ************************************************************************
10  DIM A$[100],B$[100]
20  A$=" `-~}<=$[kX&%%X*"
30  B$="               HO"
35  E$="E"
40  L=LEN(A$)
50  REM *** N: # OF TIMES EACH LINE IS PRINTED ***
60  N=2
100  REM ***FUNCTION TO BE GRAPHED***
110  DEF FNZ(X)=COS(X*Y)
200  REM ***CONVERTS VALUE OF FNZ(X,Y) INTO A POSITION ON A$ AND B$***
210  DEF FNP(X)=INT(L*(FNZ(X)-R1)/(R2-R1))+1
1000  REM ***INPUT PARAMETERS***
1010  PRINT "HOW MANY PRINT POSITIONS";
1020  INPUT W
1030  PRINT "SPECIFY INTERVALS AS FOLLOWS: LEAST$,GREATEST$"
1040  PRINT "INPUT DOMAIN INTERVAL OF X-AXIS:";
1050  INPUT X1,X2
1060  PRINT "INPUT DOMAIN INTERVAL OF Y-AXIS:";
1070  INPUT Y2,Y1
1080  PRINT "HOW MANY PAGES OF OUTPUT";
1090  INPUT M
1100  MO=(M-1)*(Y1-Y2)/2
1110  PRINT "SET RANGE OF FNZ(X,Y) ATOMATICALLY? ";
1120  LINPUT X$[1,1]
1130  IF X$="Y" THEN 1170
1140  PRINT "INPUT RANGE OF FNZ(X,Y):";
1150  INPUT R1,R2
1160  GOTO 1300
1170  REM ***AUTOMATIC RANGE FINDER***
1180  PRINT "***THIS WILL TAKE AWHILE.  PLEASE HOLD ON."
1190  R1=999999.
1200  R2=-999999.
1210  FOR Y=Y1 TO Y2 STEP -(Y1-Y2)/(.6*W)
1220  FOR X=X1 TO X2 STEP (X2-X1)/W
1230  IF FNZ(X)>R1 THEN 1250
1240  R1=FNZ(X)
1250  IF FNZ(X)<R2 THEN 1270
1260  R2=FNZ(X)
1270  NEXT X
1280  NEXT Y
1290  PRINT "LOWER BOUND="R1,"UPPER BOUND="R2
1300  R1=R1-.00001
1310  R2=R2+.00001
2000  REM ***OUTPUT ROUTINE***
2010  PRINT LIN(2)
2020  FOR Y=Y1+MO TO Y2-MO STEP -(Y1-Y2)/(.6*W)
2030  FOR I=1 TO N
2040  FOR X=X1 TO X2 STEP (X2-X1)/W
2050  P=FNP(X)
2060  IF P >= 1 AND P <= L THEN 2090
2070  PRINT  USING "#,A";E$
2080  GOTO 2130
2090  IF I=2 THEN 2120
2100  PRINT  USING "#,A";A$[P,P]
2110  GOTO 2130
2120  PRINT  USING "#,A";B$[P,P]
2130  NEXT X
2140  PRINT LIN(0);
2150  NEXT I
2160  PRINT
2170  NEXT Y
2180  PRINT LIN(10)
9999  END
```

This statement dimensions strings A$ and B$ to hold 100 characters each. The strings are scalars, not arrays.

Just a fancy INPUT statement which puts the first character typed into X$. It does not print a ? as a prompt.

PRINT LIN(2) results in the printing of three blank lines: two because of the LIN(2) function, and a third from the PRINT statement itself.

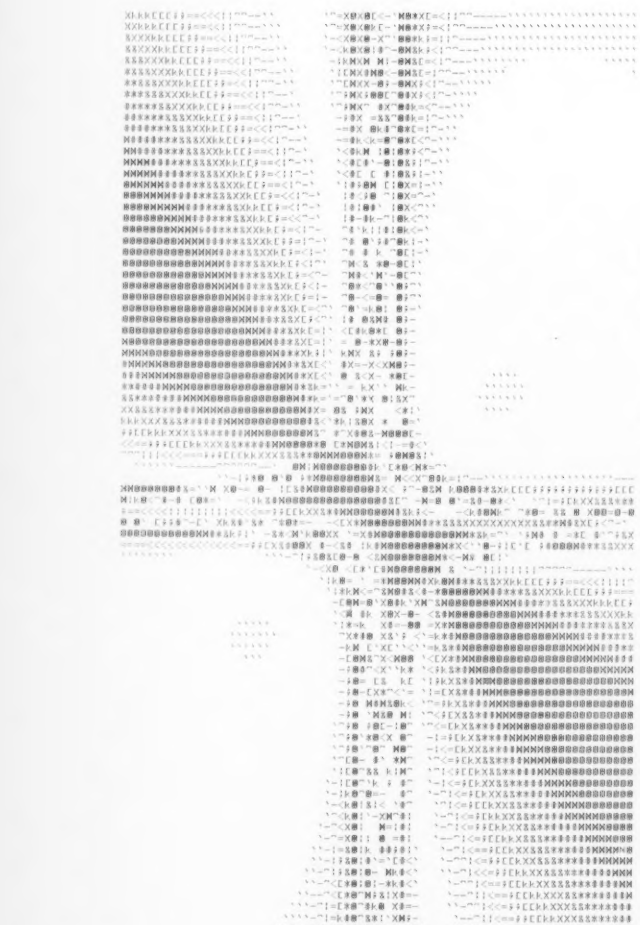
The PRINT USING causes the printing of the leftmost character of E$ with no carriage return or linefeed after printing. The # character is used for carriage control.

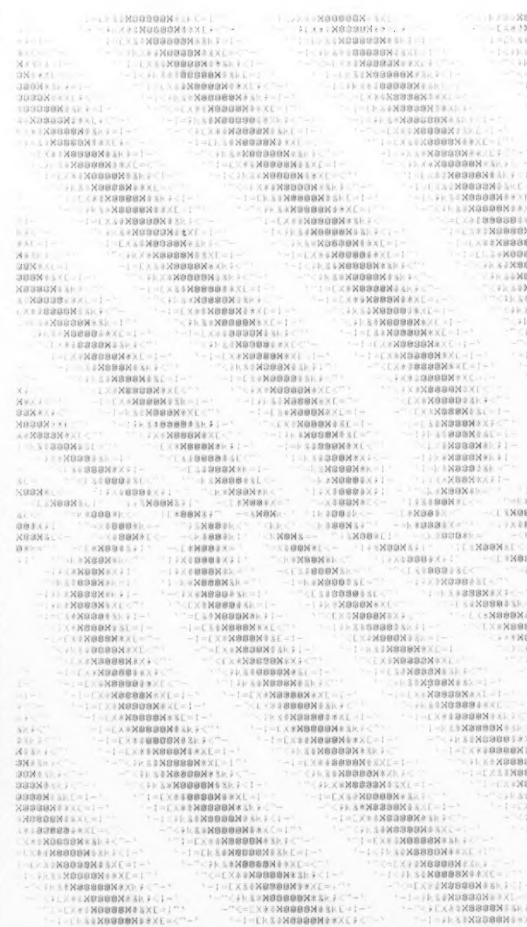
Likewise. Note that A$(P,P) is a substring—the character at position P in A$.

PRINT LIN(0); prints a carriage return but no line feed, so that a line may be overprinted. Use PRINT CHR$(13); in some other BASICs.

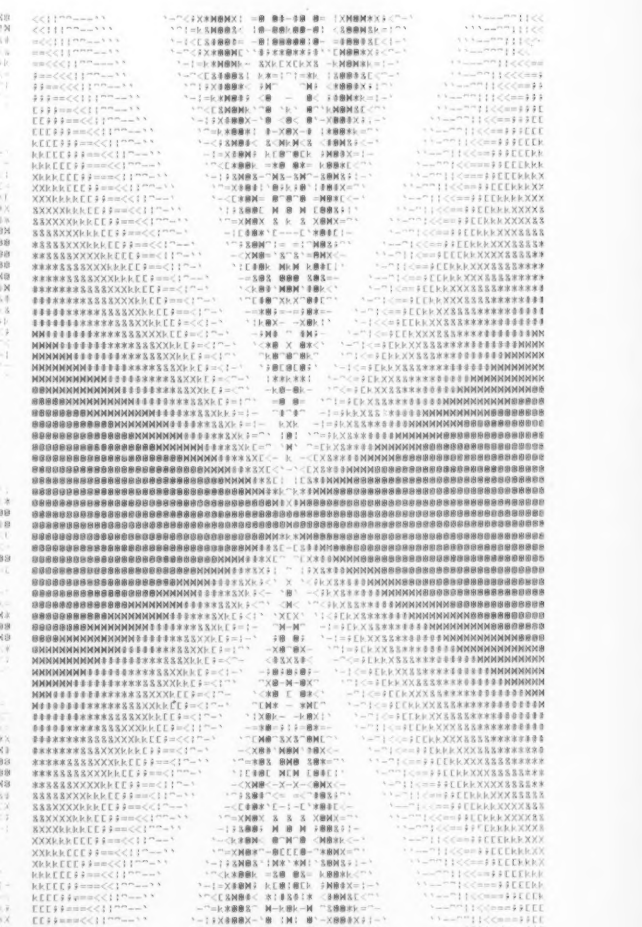
Prints 11 blank lines at the end of the printout.

```
110  DEF FNZ(X)=COS((X+Y)/(LOG(ABS(X*Y+.5))))

RUN
XYZ2

HOW MANY PRINT POSITIONS?74
SPECIFY INTERVALS AS FOLLOWS: LEAST#,GREATEST#
INPUT DOMAIN INTERVAL OF X-AXIS:?-5,5
INPUT DOMAIN INTERVAL OF Y-AXIS:?-5,5
HOW MANY PAGES OF OUTPUT?2
SET RANGE OF FNZ(X,Y) ATOMATICALLY? NO
INPUT RANGE OF FNZ(X,Y)?-1,1
```

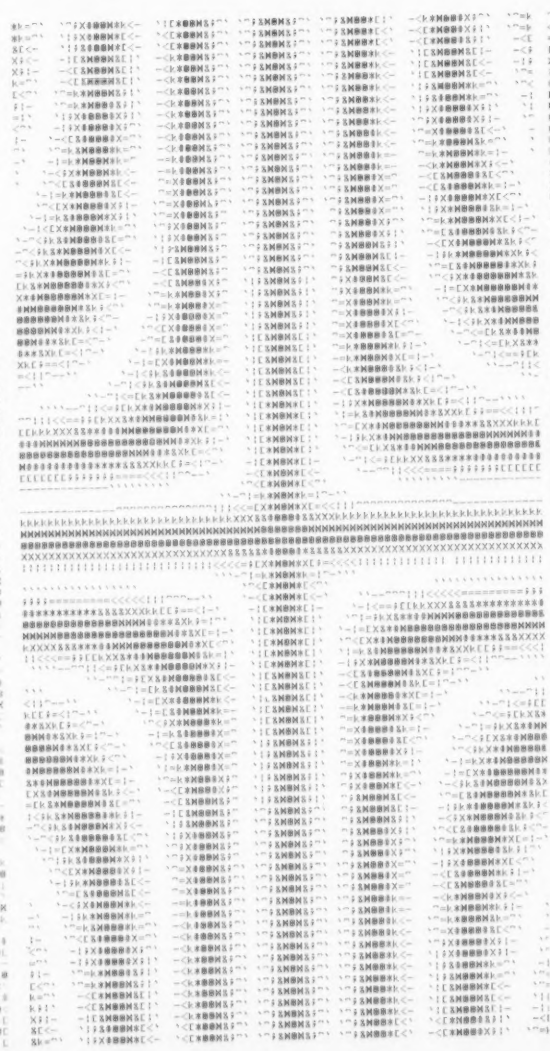




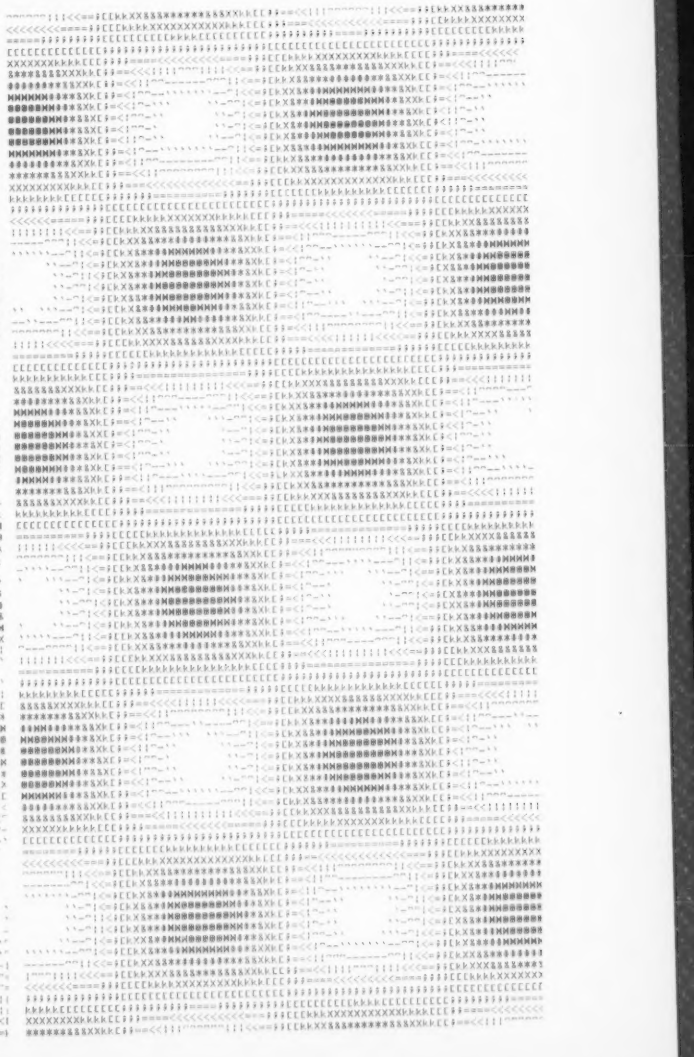
```
110  DEF FNZ(X)=COS(Y/(ABS(X)+.5))

RUN
XYZ2

HOW MANY PRINT POSITIONS?74
SPECIFY INTERVALS AS FOLLOWS: LEAST#,GREATEST#
INPUT DOMAIN INTERVAL OF X-AXIS:?-10,10
INPUT DOMAIN INTERVAL OF Y-AXIS:?-10,10
HOW MANY PAGES OF OUTPUT?2
SET RANGE OF FNZ(X,Y) ATOMATICALLY? NO
INPUT RANGE OF FNZ(X,Y)?-1,1
```



```
110  DEF FNZ(X)=COS(X*Y/SQR(X^2+Y^2))

RUN
XYZ2

HOW MANY PRINT POSITIONS?76
SPECIFY INTERVALS AS FOLLOWS: LEAST,GREATEST
INPUT DOMAIN INTERVAL OF X-AXIS?-20,20
INPUT DOMAIN INTERVAL OF Y-AXIS?-20,20
HOW MANY PAGES OF OUTPUT?2
SET RANGE OF FNZ(X,Y) ATOMATICALLY? Y
***THIS WILL TAKE AWHILE.  PLEASE HOLD ON.
LOWER BOUND=-.999996          UPPER BOUND= 1.
```



```
110  DEF FNZ(X)=SIN(X)*SIN(Y)

RUN
XYZ2

HOW MANY PRINT POSITIONS?75
SPECIFY INTERVALS AS FOLLOWS: LEAST,GREATEST
INPUT DOMAIN INTERVAL OF X-AXIS?-5,5
INPUT DOMAIN INTERVAL OF Y-AXIS?-5,5
HOW MANY PAGES OF OUTPUT?2
SET RANGE OF FNZ(X,Y) ATOMATICALLY? NO
INPUT RANGE OF FNZ(X,Y)?-1,1
```



BACKGAMMON COMPUTERS

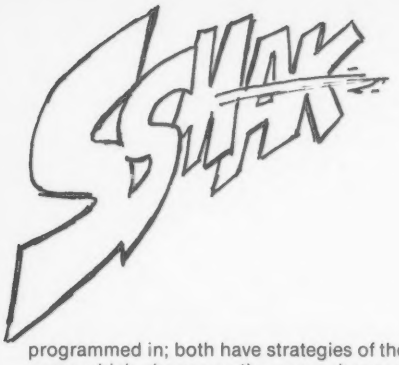
An Ancient War Game Put into Microprocessors

by John Gaines

Backgammon is an ancient game — dating some 5000 years ago to the Sumerian (now Iraqi) civilization. In the last five years this ancient game has been programmed into microprocessors. Perhaps you have seen the stunning black and white backgammon board on display with the King Tutankhamen exhibit. The board is not identical to today's board, and the game was undoubtedly a little different, but the basics were probably the same. Imagine the disbelief on that child-king's face if, 3500 years ago, someone had told him that all and more of his backgammon knowledge would be squeezed into a few chips of metal.

A millenium after King Tut, Plato was playing backgammon with his peers and writing about the mathematical exercise and philosophical virtues of the game. The ancient Romans not only played backgammon, and built rooms and halls to socialize the game, but are also said to have added a touch of strip-poker to the game. That's something a micro-computer cannot do very well. In the history of the game we cannot forget Thomas Jefferson who kept a notebook during the three week period allotted to him to draft the Declaration of Independence. One entry says he played backgammon with a friend and lost. Another says he played and won. If Jefferson had had a computerized backgammon game to keep him company during that difficult three weeks, the Declaration may never have been written!

We know of only two microcomputer backgammon sets on the market, and both are reviewed in this article. In fact, we have played the two sets against each other — which we believe has never been done before — and the results are reported here. One unit is called Gammonmaster II and is made by Tryom, Inc. of 23945 Mercantile Road, Cleveland, Ohio 44122. The other is called Computer Backgammon and is made by Texas Micro Games, Inc., 6230 Evergreen, Suite E, Houston, Texas 77081. Both units have all the rules of the game



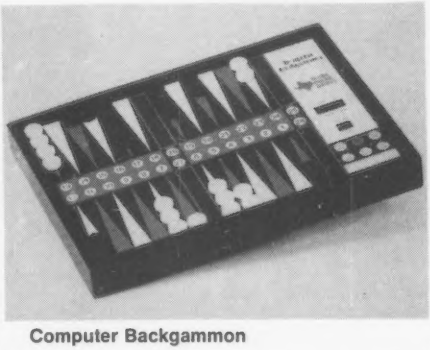
programmed in; both have strategies of the game which change as the game changes; and both are out to win. Before we review the software and hardware fundamentals of each unit and play them against each other, let us first review the basics of the game so we can better understand what the computerized units do.

Each player has 15 pieces which he must move around the board according to the roll of the dice, and which he must bear-off the board. The first player to bear-off, or remove, all his pieces wins the game. A typical game has a fair amount of action and strategy and is over in a half-hour or so. Because there is an element of chance in the game, the world's best player can be beaten by a novice, and for this same reason it is common to play more than a single game at a sitting with your opponent.

The board has twelve triangles on each side which are spaces the pieces can occupy. The triangles alternate in color between white and some other color — say red. The alternate coloring is of no importance to the game but does help in counting the number of spaces to move a piece. Also, by tradition only, the alternate color — red in this case — is also the color of white's opponent. So we have 15 white and 15 red pieces moving around the board, trying to form offensive and defensive positions as needed, and trying to get off the board first. There is a vertical strip running down the middle of the board called the "bar." When playing white, your "home" board is composed of the six triangles to the right of the bar. Red's home board is opposite yours (so it is to his left as he sits on the other side of the board). A player must get all of his pieces on his home board before he can start bearing-off pieces. Your "outer board" is exactly the same six triangles that compose your opponent's home board, and vice versa. The triangle to your right (as you play white) will always be white and is called white or lower point no. 1 where the word "point" in this case comes from the point of the triangle. The word "point" can also mean two pieces of the same color are on one triangle — which is a confusing double use of one word. The triangle above lower point 1 is called upper point 1. So for white the triangles are numbered 1 through 12 going from right to left. For red the triangles hold exactly the same point numbers but because red sits on the other side of the board they run left to right for him.

The starting position is as follows for white: lower point 6 has 5 pieces; lower 8 has 3; upper 12 has 5; and upper 1 has 2. The starting position for red can be read the same way, that is, red's lower point 6 has 5 pieces, etc. The result is that opposite white on any point are an equal number of red pieces. The game starts by each player rolling one die. The player with the higher roll begins by taking the numbers on the two dice. The two computerized backgammon games have this same rule built in. If the roll of its electronic dice (or the roll you make with real dice and enter into the computer, in the case of Gammonmaster) give yours as higher, than you start.

Suppose you are playing white and the roll is 5, 3. You are to make the opening move of the game. You can move one piece 5 triangles and one 3 triangles (or spaces, or points — whatever term you prefer). There are many ways to do this, and the probabilities of your opponent getting a certain roll in his move is one function to consider in choosing the move. But more basic than that mathematical play — which is really the essence and skill of the game — is the rule that says where you cannot move your pieces. Wherever red has two or more pieces there is a "block" and you cannot land there. That is the only rule that determines where pieces are not to go in backgammon. So with 5, 3 your opening move cannot be upper 1 to upper 6 even though that is a count of 5 because red has more than two pieces on the upper 6 point. But there are six legal moves you can make with this 5, 3 roll. Which do you take? Here is where the microcomputer can pull together the resources of those backgammon lovers who have programmed it to come up with the best move. During the middle of the game, when pieces are spread all over, the best move will require human and computer alike to weight various possibilities in order to choose the best one. No two humans will think alike on every decision that is to be made during a game — the playing behavior, characteristics and experiences of individuals differ and



Computer Backgammon

therefore their games differ. Likewise, the computers will — and do — play differently. But not on an opening move. On the opening move there is generally one sound move to make and both humans and computers alike are programmed to make those openers. In the case of 5, 3 the best move without doubt is: one white piece from lower 8 to lower 3, and one piece from lower 6 to lower 3. Doing this, you have created a block on the 3 point. The value of this block is twofold. First, you are getting one piece onto the home board in a safe fashion — the block protects it — that was not there before. Second, you make it a little more difficult for red to get a dice roll that will allow him to move the two men on his outer board.

Of course, white had a bit of a lucky roll. If white had rolled 2, 1, the choice of a move would have been from among bad moves. There is no good opening move for a 2, 1 roll. The best you can do with it, some say, is to move one piece from upper 12 to lower 11, and one from lower 6 to lower 5. The object is to form a blot on lower 5 that may be converted to a block on the next roll. It is a bit risky. Red may roll a 4, X; hit that white blot; and send it to the bar. If that happens, white must re-enter that piece on the outer board — all the way opposite of the precious home board — before he can move any other piece. To re-enter it, white rolls, for example, 6, 2 and enters on the upper 2 point. He cannot enter on the upper 6 point because there are presently five red pieces there.

Finally, "double" is a special word in backgammon — for two separate reasons. First, if a player rolls doubles, like 5, 5, he gets to move four pieces each five places — not just two pieces five places. Of course, he may move one piece four times because that is equivalent to moving four pieces each once. This doubling rule is absolutely devastating when bearing-off because it means you can take four pieces off rather than just two. Actually, the rules and strategy for bearing-off take a lot of words to explain on paper, so we will not go into it here, but getting doubles when bearing-off has the essential effect of getting four pieces off instead of two. Second, there is a doubling cube that is as much a part of backgammon as money in a poker game. The cube sides read 2, 4, ---, 64. If you're playing for a point for each game won — or for $1000 a game as happens in Las Vegas — you can up the stakes by using the cube. One begins by turning it with side 2 up. If the opponent accepts, he believes his position is better than you think it is. The game is then worth two times the original game. The cube can be advanced by either player at any time. If a player rejects his opponent's raising of the stakes, he loses the game. The Gammonmaster has a doubling cube built into its logic and shown via LEQs on the front panel. If you accept its challenge, the game value will be increased — and it keeps a running score of game socres from the time it is plugged in. If you reject the doubling cube, you concede the game. If, however, you press a clear button, the doubling cube is ignored and the game can continue. There is also provision for you to double the Gammonmaster. If it rejects the offer, you have won the game.

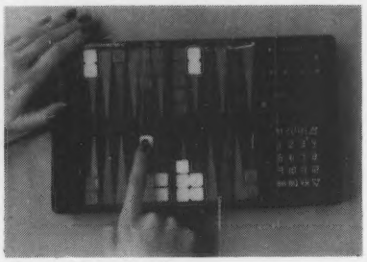
Those are the rules and basics of the game. Now we can take a peek at the physical layout of the two computer sets. Both have touch switches under a plastic or rubber pad, although the Computer Backgammon set of Texas Micro Games requires less pressure because it uses true micro-diaphragm switches. Both allow verification, or memory interrogation of the board to be certain you and the computer agree. Computer Backgammon has an update feature that allows pieces to be moved around at will. An entire board can be set up to play a particular problem although the dice rolls cannot be forced into the computer so you would have to take the problem with the computer's electronic dice roll. If you make a stupid move, the update feature lets you change it. Or if someone trips over the cord causing your game to be lost, you can use update to reset the

positions in the computer memory. Interestingly, the unit does not check or even care how many pieces are on the board, so you can use update to add a few red (computer) pieces in order to give yourself a slight advantage. This is a rather different approach to creating equality between opponents. The Gammonmaster II, which is the very latest version from Tryom, does not have an update capability. It does allow the player to change his mind but only before the move is entered into memory. Once entered, you are stuck to play it. Board positions cannot be set up on that unit.

The two units also differ in rolling of the dice. The Computer Backgammon shows the result of its electronic roll — following your pressing of a "roll" button — via two seven-segment LEDs. So it shows the numeric result. The Gammonmaster II, like the I before it, has simulated die faces. As the dice roll you can see the dots on the die faces changing. You then touch a button to stop the roll and take what you get. This feature of telling the computer when to stop rolling is the result of a long list of complaints that both Texas Micro Games and Tryom have received. The complaint is always the same: "The computer cheats. It rolls doubles more for itself than for me. And it rolls what is best for it." Both companies carefully reviewed the completely random method used to roll the dice and have found that there is no way the computers can have a bias in its favor or in the player's favor, although they agree that human nature will let you think there is a bias sometimes. Tryom's answer was not just the ability to stop the roll when you want to, but also to enter dice values in place of the electronic dice. So you can roll your own dice and enter the values both for yourself and for the computer. Texas Micro Games is thinking about adding this feature to their game.

Now let's see how the computer versions do their thing. As with the backgammon game in BASIC listed in our July/August 1978 issue, these two games have the basic approaches of forming blocks as pieces advance, forming primes, hitting opponents' blots and favoring moving of the furthest piece from the home board. Those are the sub-goals — it is how each computer achieves these sub-goals that makes them different. The Computer Backgammon set by Texas Micro Games will be discussed first. Its strategy is to internally try every possible move that is consistent with the roll of its dice. Each resultant board position is analyzed for such items as vulnerability, potential to form future blocks, and potential advantageous position for bearing-off. Each possible move is assigned values which are then compared to pick the best move. Probabilities of the opponent rolling particular numbers on his next move are not explicitly considered, although the best position does implicitly consider such probabilities by simply using standard rules about best position. If the computer can make two blocks, for example, the one furthest from home will be made. It tries to get home fast by pulling up the rear. This approach provides a natural tendency to form primes wherein six adjacent points are occupied by one player. If the computer can form a blot on one of its moves, it will consider the probability of being able to get back onto its outer board. If that board is jammed with blocks by the opponent, the Computer Backgammon unit will try not to leave blots. This is the one look-ahead feature of that computer.

The Gammonmaster does some different computations to determine where to move its pieces. Tryom says the computer has several different strategies to choose from depending on whether it is just opening the game, holding even in the game, or badly losing. When losing badly it can go into a "back game" which is an approach involving forming blocks on your outer board and attempting to hit the opponent as he comes home. It is difficult and a last-ditch effort, but it can turn the game around. When opening the game, the Gammonmaster begins a block-run game, which is a common maneuver among backgammon players. The object is to advance quickly but safely by forming blocks which simultaneously tie up the opponent. To determine what move to make during a game, the computer calculates over 50 different values corresponding to various positions, the level of the game, the phase of the game and other considerations. These are compared for each possible move before one move is selected.



Gammonmaster II

Perhaps the most fascinating aspect of Gammonmaster's software is that it learns what type of player you are, and styles its game accordingly. There is a quasi-learning process wherein the computer looks at your move, determines whether it might have made that move and why or why not. Then it begins labeling you, and each of its opponents, as conservative, aggressive, wise or as passing up opportunities. It begins to build up a small table of the types of moves you make and of the type of player you are. As Gary O'Hara, the programmer of Gammonmaster explained in an interview with us: "If it builds an aggressive table against you — if it thinks you are aggressive — maybe because you take unnecessary chances, it will put that in its goal structure. It will take opportunities to trap you into taking unnecessary chances. Likewise, if it labels you as a conservative player, it will take some chances that it does not think you will capitalize on. So it does not play two different players the same way."

Besides a difference in software, there is also a difference in hardware within the two computers. The Computer Backgammon uses an Intel 1835 MPU which is an 8 bit unit containing 64 bytes of RAM on the chip. The program is stored in 3 kilobytes of ROM where 2 kilobytes are for strategy and 1 kilobyte is for I/O control. There are a total of 10 integrated circuits. Both computers have RAM for scratchpad memory. That's where the values of moves are stored temporarily, and where the board position is stored.

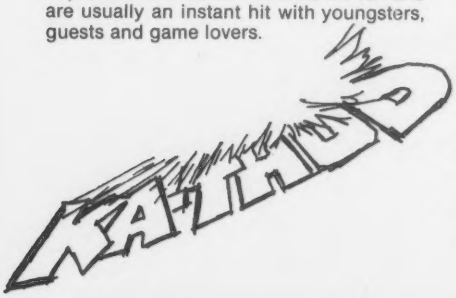
The big event was playing the two computers against each other. A "first" as far as we know. To carry out this contest required more mental exercies and more time than we expected. The underlying difficulty was that neither computer is designed to play the white pieces. Both are fixed to play only the red pieces. But the solution was found: Gammonmaster will accept a dice roll as an input both for its turn and for its opponent's turn. So we let the Computer Backgammon play the red (actually the brown on it) pieces. When it was red's turn to play, we would roll the electronic dice of the Computer Backgammon. We would play that red move on the Gammonmaster as a white move. This was done by entering red's dice roll and red's corresponding move into Gammonmaster when it asked its opponent to play a move. Then the Computer Backgammon would expect its opponent to play. We would get the move to feed into it from the Gammonmaster, where the move there was really a red move. So we were able to play a completely fair game with the computers. The intelligent move from one was fed into the other. The only problem we had was with ourselves. Since we were translating red to white, we had to make mirror images of the moves from one computer to the other before entering those moves into the receiving unit. The mental exercise came in keeping the numbers straight, and the long time — about an hour per game — came about because of the care we had to take in every button press. Even with that care we blew several games by hitting a wrong button. We did, however, finish three games between the two computers.

Three games are not enough to make a judgment about which unit plays better. From a statistical viewpoint, about 30 games are needed before any significance can be given to the outcome. We must say, however, that while it may be a bit of good luck — roll of the dice and all that — the Gammonmaster came up the winner all three times. The games were all different in the mid-game although they were all similar toward the end. In the first game the Computer Backgammon set (playing red) got an early break with its back two pieces and made a lover's leap from its upper 1 to its upper 11. The second piece also broke out early. Before long its pieces were all heading home and were nearly scott-free while the Gammonmaster's outer pieces were still stuck. No hits were made up to this time. At that point the tide turned. Red had left a blot on its lower eight point, which is not necessarily a bad risk. The 7 point was open and white rolled (remember, the roll was actually on Computer Backgammon, then fed to Gammonmaster, so white could not cheat) a 6, 1. The red piece on 8 was hit and could not re-enter for three rolls because white had formed several blocks on its home board. That sequence on rolls was the deciding factor. Red lost with only three pieces on its home board. The second game was a steal the other way. White had a strong lead from the start and kept it. Hits were exchanged but white advanced faster than red primarily due to some well-timed

doubles on the dice. Red had ten pieces left as white finished.

The third game was the most interesting. Neither computer appeared to have a strong advantage at the start. Both had a mix of good and mediocre rolls that allowed blocks and blots to be left. The result of that start was a really spread-out board during the mid-game. Both white and red had about half their pieces away from home. But there was one difference that ended up determining the game. Gammonmaster began jamming in red's two pieces on the 1 point that had not yet started moving toward home. Before long a wall of white pieces faced those two red men. At that point Gammonmaster challenged its opponent with its internal doubling cube. We accepted the challenge on behalf of the Computer Backgammon unit. White won but red managed to get those two pieces home. Red had five pieces left when white declared itself the winner.

There we have it. Microprocessor competition based on the ancient game of backgammon. King Tut would have been impressed. We were. The units are fun and are usually an instant hit with youngsters, guests and game lovers.



WORDS OF THE GAME

Backgammon - If a player bears-off all his pieces — and thereby wins — and simultaneously his opponent still has at least one piece on the winner's home board, the winner has achieved a "backgammon." When scoring, a backgammon is worth three times a normal win.

Bar - A space vertically down the middle of the board to which a piece is sent temporarily if hit by an opponent's piece. See "blot" below.

Bearing-off - The final stage of the game wherein a player has all of his pieces on the home board and begins rolling dice to take his men off the board.

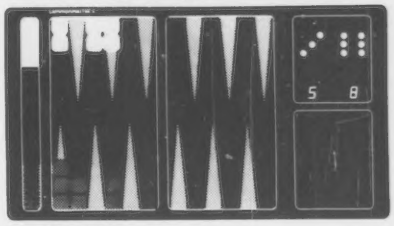
Block - Any triangular space, or point, on the board occupied by two or more pieces of the same player. The opponent's pieces cannot land on a block. Another term for block is "point." When betting, each "point" made is worth a predetermined amount.

Blot - A space with only one piece on it. If a blot is hit, or landed on, by an opponent's piece, that blot piece is sent to the bar. It must then be re-entered by the roll of the dice to the opponent's home board before any other move by that player.

Lover's Leap - An opening 6, 5 move in which a player moves one of his two furthest out pieces eleven spaces.

Prime - Six adjacent spaces which are only occupied by pieces of one player. These six spaces may be anywhere on the board. Primes can be useful during the middle portion of a game for creating a barrier the opponent cannot cross easily. ■

It plays you!



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CIRCLE 149 ON READER SERVICE CARD

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CIRCLE 121 ON READER SERVICE CARD

CRITICAL PATH ANALYSIS

Ruth M. Sabean with Margot Critchfield and Thomas Dwyer

Originally prepared as part of Project SOLO, Dept. of Computer Science, University of Pittsburgh, Pittsburgh, PA 15260. Note: Project SOLO ended in 1977 and was not renewed. Please do not write for materials since the staff has disbanded.

PART I

CRITICAL PATH ANALYSIS

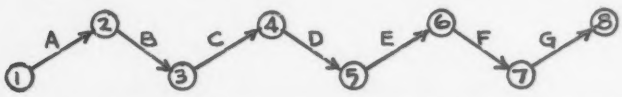
The time is Saturday afternoon; the place is your neighborhood computer terminal; the scene is you hunched over the keyboard happily watching your prize program plot the intersecting paths of two globs from outer space. Suddenly—you glance at your watch, quickly log off, dash to your locker and head for home.

What we just witnessed was an instantaneous application of *Critical Path Analysis.* The same logic which you used to decide that there were just 15 minutes to get home in time for supper, in order to meet your friend at the Field House, and get a good seat at the basketball game, is used in the analysis of highly complex projects which might involve as many as 5000 separate activities. Knowing just which of those activities (maybe only 10%) is critical to the successful completion of the project on a given time schedule is what Critical Path Analysis is all about.

The first step in the analysis is determining what activities go into the project and the time for each. When you got up that Saturday morning you probably thought about everything you wanted to get done that day along with the approximate amount of time you would spend doing it. Your mental list might have looked something like this:

Code Letter	*Description of Activity*	*Time Required (Hours)*
A	Work at part-time job	3.0
B	Quick lunch	.5
C	Workout at gym	2.0
D	Session on terminal	3.0
E	Travel home	.5
F	Eat supper	1.0
G	Travel to Field House	.5

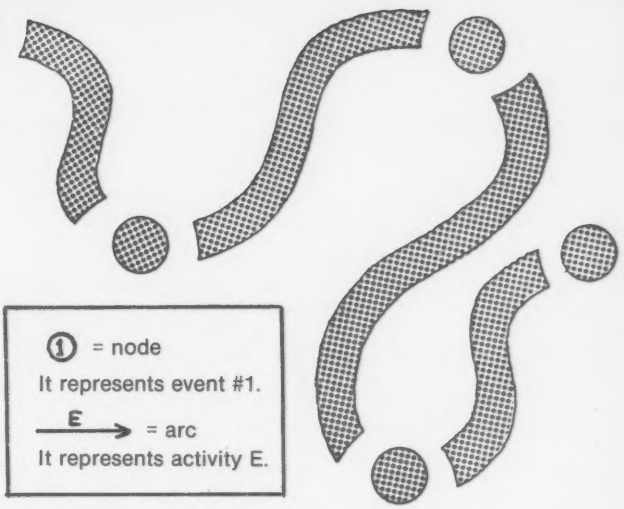
One graphic representation of your day would look like this:



A pictorial representation of this kind is called a "weighted linear graph," or more simply, a *network.** The lines with arrows are called *arcs.* These represent activities. The small circles are called *nodes.* These represent events (or moments) in time where activities start or stop. For example, node #6 represents the event of arriving home to eat. Activity E (travelling home) stops at node #6, while activity F (eating supper) starts at node #6. For this reason, we call activity E an immediate *predecessor* of activity F. Activity G would be called an immediate *successor* of F.

*More exact definitions for *linear graph*** and *network* are the following:
A directed graph (digraph) is defined as a set of nodes and a set of ordered pairs, called arcs. An arc has the form (a,b) where a and b are members of the node set; (a,b) is represented by a line joining a and b with an arrowhead pointing from a to b. A digraph that has numbers called "weights" associated with the arcs (or nodes) is called a weighted digraph or *network.*

** Footnote on the footnote: Don't confuse linear graphs with the Cartesian X-Y graphs studied in geometry.



PRECEDENCE TABLES

Showing the relationships between activities is a necessary part of the planning process. One way to do this is to use a precedence table. The precedence table for this particular process would look like this:

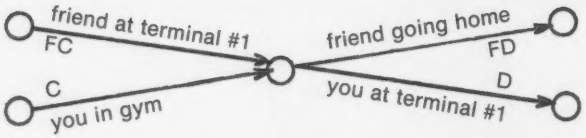
Activity Identification	*Activity Description*	*Immediate Predecessor*	*Duration (Hours)*
A	Saturday a.m. job	—	3.0
B	Lunch	A	0.5
C	Workout at gym	B	2.0
D	Session at terminal	C	3.0
E	Travel home	D	0.5
F	Eat supper	E	1.0
G	Travel to Field House	F	0.5

In order to keep our example as uncluttered as possible, we have omitted all the activities which don't directly involve you, but on which your activities depend. For example, you can't start work on your program until the student before you logs off. Similarly, there would be no point in cutting your terminal time short by one hour and rushing home for dinner if there would be nothing ready to eat.

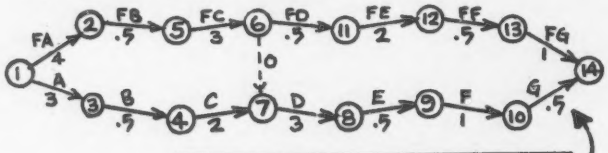
Let's see what happens to the precedence table and graph if we introduce just a few of thes complexities into our process. We'll make the schedule of your day (Y symbol below) partially dependent on your friend's schedule (F).

Activity	*Description*	*Immediate Predecessor(s)*	*Duration (Hours)*
A	Y - at work	—	3.0
FA	F - at work	—	4.0
B	Y - lunch	A	0.5
FB	F - lunch	FA	0.5
C	Y - gym	B	2.0
FC	F - use terminal #1	FB	3.0
D	Y - use terminal #1	C, FC	3.0
FD	F - going home	FC	0.5
E	Y - going home	D	0.5
FE	F - studying	FD	2.0
F	Y - eating supper	E	1.0
FF	F - eating supper	FE	0.5
G	Y - getting to Field House - Meet F	F	0.5
FG	F - getting to Field House - meet Y	FF	1.0

Activity D is of most interest to us. Both the table and graph show that activity D has two immediate predecessors: activities C and FC. One possible way of graphing this relationship would be the subgraph:



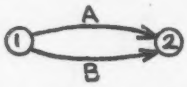
But this subgraph could be misleading. It suggests that *before* either activity FD *or* activity D may begin, *both* activities FC and C must be completed. The precedence table, on the other hand, makes it clear that your friend may start for home even if you decide to overstay at the gym. It is only activity D that has as immediate predecessors activities FC and C. Activity FD has *only* activity FC as an immediate predecessor. Whenever activities share either all or some activities as immediate predecessors, we need another way of indicating this on the network. Here's what we do:



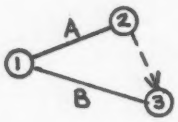
NOTE: We can also describe activities with number pairs. For example, G can also be described as (10,14).

Notice the dotted line arrow connecting nodes 6 and 7. This device is called a *dummy activity* and has a duration of zero. Its only function is to accurately represent the relationship between nodes 6 and 7.

The dummy activity is also used to handle the problem of multiple activities with the same start and end nodes. We would like to be able to refer to activities by their corresponding node pairs, but this means that each activity must have a unique node pair for its "name." For example:



means that both activities A and B are represented by the node pair (1,2). However, the use of a dummy activity provides the uniqueness we require without altering the relationship.



Now A = (1,2)
and B = (1,3)

THINK TIME

Now that we've analyzed the process into its component parts, we are ready to begin asking some questions:

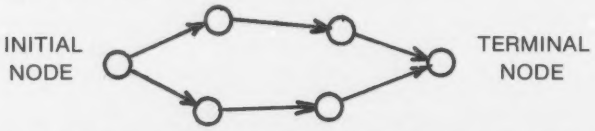
1. How long will the complete process take?
2. Which activities in the process is it important to complete on time?
3. Which activities could be cut short and thus decrease the total time?

If you already have all the answers in your head, you're in good shape. Let's see how you did.

Question One: How long will the complete process take?

What we are really asking here is this: If both you and your friend begin work at 9 o'clock Saturday morning, who will arrive *last* at the Field House and at what time? What is the *longest* path through the network?

By the term path, we mean a sequence of activities, starting at the *initial node* of the network and ending at the *terminal node.*



In our sample network there are three paths from initial to terminal node. We can describe these by listing all the node numbers we pass along the way. The first, *Path 1*, is 1, 2, 5, 6, 7, 8, 9, 10, 14. *Path 2* is 1,2, 5, 6, 11, 12, 13, 14 and *Path 3* is 1, 3, 4, 7, 8, 9, 10, 14. (Notice that the node numbers are increasing with time. This method of numbering activities, while not necessary, does make it easier to check that there is no looping back in the graph. If we permitted cycles, we would have the curious possibility of having to complete an activity before we began it. Critical path problems have acyclic graphs.)

The length of the path is the total time it takes to travel it, that is, the sum of the activity durations along it. This would give us the following path lengths:

Path 1 12.5 hours
Path 2. 11.5 hours
Path 3 10.5 hours

Answer

A path is said to be a *critical path* if it is the longest path in the network. Activities along the critical path are called *critical activities.* To shorten the time required for the process, we must concentrate on shortening one or more of the critical activities. Note that it is possible for there to be more than one critical path. If your friend had to work only two hours at activity (1,2) then Path #1 would be 10.5 hours as would Path #3, while Path #2 would now be 9.5 hours. Thus Paths 1 and 3 would now both be critical paths.

Question Two: Which activities in the process is it important to complete on time?

To answer this, you should ask questions like: Could my friend have a more leisurely lunch and not delay the time at which he will meet me at the Field House? Or could I work an extra hour at my part-time job and still meet him at the time we arranged? The answers to these questions are found by tracing the activities along the critical path:

(1,2), (1,5), (5,6), (6,7), (7,8), (8,9), (9,10), (10,14).

Your friend's lunch time is a *critical* activity (2,5) and, therefore, the total process time will increase if he takes

more than the estimated half-hour. *Critical activities must be completed on time.*

On the other hand, your part-time job (activity (1,3)) is *not* on the critical path. If you decide to work an extra hour you can still be ready to debug (at event 7) when your friend finishes his terminal session.

> *Question Three: Which activities must be cut short to decrease the total process time?*

Once you have answered question two, then you also know the activities on which to concentrate in order to shorten the total time: the critical activities.

For example, suppose your friend's boss informs him that he may leave early that morning. Will reducing the duration of this activity have any effect on the overall process length? Or is it time *you* spend at your job which really needs to be cut short? Look back at the graph on page 4. Are either of these activities on the critical path? Use this information to decide which job should be shortened in order to decrease total process time.*

PART II

GETTING READY TO USE THE COMPUTER

Up to now we have been able to supply answers just by careful study of the data. Keep in mind though what it would mean to be asking the same questions about a process involving a few thousand activities.

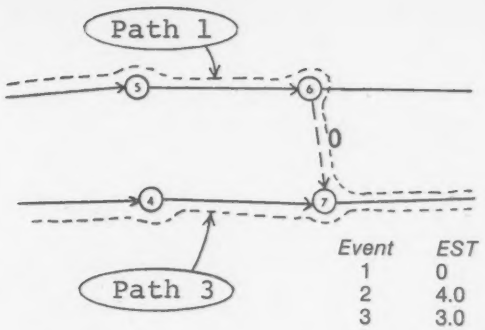
What we need now is an algorithm (set of rules) for finding the critical path, its length, and the spare time for non-critical activities. This is especially true if we want to use a computer for attacking complex networks.

ăl′gə-rĭ*th*′əm

The first step in developing an algorithm is to define something called EST. Look at event 2 on the graph. The earliest time we can be at this event is when activity (1,2) has been completed. We say then that the EST (*Earliest Start Time*) of node 2 is 4.0 hours. Similarly, if activity (2,3) requires .5 hours and cannot begin until 4 house have elapsed, then the EST of node 3 is 4.0+.5 (the EST of the preceding node plus the duration of the activity connecting them). And so we continue along path #2 calculating ESTs for each node, using the previous calculation to form the next.

Hardly a problem for a computer, you say! But look at node 7. Up to now, all nodes have only one activity leading into them. The EST for each was a simple process of addition. However, node 7 can be reached from node 6 and from node 4. The calculations so far are:

*Answer: Activity (1,2) is critical



Event	*EST*
1	0
2	4.0
3	3.0
4	3.5
5	4.5
6	7.5
7	7.5 *or* 3.5?

Coming from node 6, the start time at node 7 would be 7.5 hours; from node 4 the start time at node 7 would be 3.5 hours. The Earliest Start Time means the earliest time we can start successor activities. Therefore it is equal to the longest path coming into the node. Path 1,2,5, 6, 7, is of length 7.5 and path 1, 3, 4, 7 is 3.5. Therefore the EST of node 7 is 7.5. Looking back at the precedence table, this means that you can't use terminal #1 until your friend has finished work, eaten lunch, and completed his turn on the terminal, a total of 7.5 hours. In general, if nodes K_i precede note I

EST of node I = maximum of [EST node K_i + duration (K_i,I)]

Again at event 14, there are two incoming paths. Notice that by choosing the longest path to the terminal node, we have also calculated the critical path length. Try calculating the remaining ESTs and compare your answers with the table on page 10.

Next we need to look at the *Latest Finishing Time* (LFT) of each event; this is the time at which an event may be finished without disturbing the process. We know that if the terminal event finishes any later than 12.5 hours after the process begins, then the process length will have increased. The LFT of node 14 is equal to the EST of node 14 or 12.5 hours.

TERMINAL NODE LFT = EST

Proceeding *backwards* along each activity, the LFT of the next node (the start node of the activity) equals the latest finishing time of its end node minus the duration of the activity. For example, if the process is to finish 12.5 hours after it started, then the latest time that your friend may finish eating dinner is 12.5 minus the time it takes for him to get to the field house (1 hour) or 11.5 hours after the start of his day.

THEREFORE:	*EVENT*	*LFT*	
	14	12.5	= EST of node 14
	13	11.5	= LFT of 14 - (13,14)
	12	?	= LFT of 13 - (12,13)
	11	?	= LFT of 12 - (11,12)

At node 6, we confront an event with more than one activity leading out from it: (6,11) and (6,7). Before deciding about node 6, go back and calculate the LFTs for nodes 10, 9, 8, and 7. Coming from node 11, node 6 event time would be 9.0 - .5 = 8.5; whereas, from node 7, we have 7.5 - 0 = 7.5. The smallest event time is the LFT for that node. In general, if I precedes nodes J_i

LFT of node1 = minimum of [LFT of node J_i - duration (I,J_i)]

The LFT of node 6 is, therefore, 7.5. If your friend finishes

his session on the terminal any later than 7.5 hours after the start of the day, the remainder of your schedule will be delayed.

EXERCISE: Calculate the missing values in the final table.

(answers below)

EVENT	EST	LFT
1	0	0
2	4	C
3	3	5
4	3.5	5.5
5	4.5	4.5
6	7.5	7.5
7	7.5	7.5
8	A	D
9	11.0	11.0
10	12.0	12.0
11	8.0	9.0
12	B	E
13	10.5	11.5
14	12.5	12.5

Finally, we now define the *float* or "spare time" for each activity. In general, for the activity going from node I to node J,

FLOAT of (I,J) = LFT of J - EST of I - duration of (I,J)

Subtracting the duration of the activity and the earliest time at which the activity can begin from the latest time at which it may end gives the spare time for that activity. For example, the float of activity (6,11) is 9.0 - 7.5 - .5 = 1.0. This means that your friend could take as much as an extra hour getting home and still meet you at the Field House on time. Try calculating the remainder of the float times and then compare your answers to the table below:

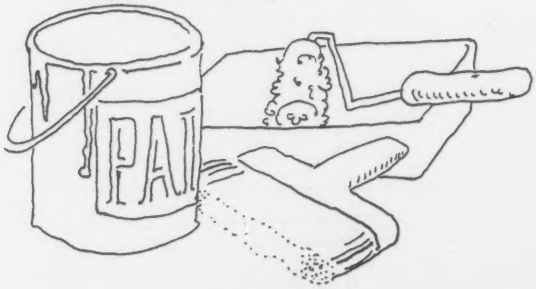
Activity	EST/Start Node	LFT/End Node	Duration (Hours)	Float (Hours)
(1,2)	0	4.0	4.0	0*
(1,3)	0	5.0	3.0	2
(2,5)	4.0	4.5	.5	0*
(3,4)	3.0	5.5	.5	2
(4,7)	3.5	7.5	2.0	2
(5,6)	4,5	7.5	3.0	0*
(6,7)	7.5	7.5	0	0*
(6,11)	7.5	9.0	.5	1
(7,8)	7.5	10.5	3.0	0*
(8,9)	10.5	11.0	.5	0*
(9,10)	11.0	12.0	1.0	0*
(10,14)	12.0	12.5	.5	0*
(11,12)	8.0	11.0	2.0	1
(12,13)	10.0	11.5	.5	1
(13,14)	10.5	12.5	1.0	1

The starred activities have zero float time and are, therefore, critical activities. If such an activity requires any extra time to complete, the length of the process will be increased; however, if its time decreases, then the critical path length is also shortened.

There are seven activities with a non-zero float. This is the extra time that may be spent on the activity without disturbing the process. For example, activity (1,3) has a float time of 2 hours. This means that (assuming your boss allows you to start work anytime) you may now sleep in two extra hours on Saturday morning without fear of keeping your friend waiting that evening at the Field House.

EXERCISE: Suppose that you and a group of friends are preparing to redecorate your game room. You have drawn up the following list of activities and estimated the length of time they will take:

Activity	Duration (Hours)
Buy Paint	1.0
Clear Room	.5
Prepare Surfaces	2.0
Paint Ceiling	3.5
Paint Walls	5.0
Clean Up	.5
Replace Furnishings	1.5



And now you would like to know:

1. How many hours the complete project will take?
2. During which activities you could use the help of an extra friend to shorten the overall time?
3. At what time you can go off to buy some new wall posters without disturbing the process?

Task 1: Invent codes for these activities and draw up a precedence table (see Part I). Assume that the buying of the paint and clearing of the room may be done at the same time. The surfaces, however, cannot be prepared until the room is cleared, but may begin even if the paint buying has not yet been completed. The remaining activities follow one after the other in the order listed.

Task 2: Draw a network from your precedence table. Be sure it is well-formed. How many initial nodes are there? How many terminal nodes? Can each activity be uniquely described by a pair of nodes?

Task 3: Now calculate the EST and LFT of each event and use these to find the float time of each activity. A table similar to the one in the preceding column makes it easier to keep track of your results.

Brain Tickler: What changes must you make in the graph if the activities of painting the walls and ceiling can go on at the same time? Include the condition that a two hour drying time activity must be inserted after the completion of the painting activities and before the furnishings are replaced.

ANSWERS: A = 10.5, B = 10.0, C = 4.0, D = 10.5, E = 11.0

PART III

DESIGNING A COMPUTER PROGRAM FOR CPA IN 4.0 BASIC

Critical Path Analysis is itself a two-stage process: the first involves breaking a process down into its activities and deciding on the relationships between them. This is a job for humans and probably will be for some time to come. The second stage involves the CP calculations and can be more efficiently done by a machine, thus freeing people to think up more processes to be analyzed ... (sigh).

Assuming that we have before us a list of activities with their node pair names and durations, we are now ready to feed them into a program which will do the pencil and paper work of calculating EST, LFT, and FLOAT and produce the corresponding critical path information.

On the following pages we introduce you to a basic program to accomplish this, program CP. First there is a description of the program flow, followed by a sample execution and some problems to try.

Initialization: Declaration of arrays; heading print out; request for user input of number of activities (notice that the maximum is 20).

```
5 REM CRITICAL PATH ANALYSIS
10 DIM S(20),F(20),D(20),E(20),L(20),F1(20)
20 PRINT "CRITICAL PATH ANALYSIS":PRINT
30 INPUT "NUMBER OF ACTIVITIES";N
40 IF N > 20 THEN PRINT "LIMIT IS 20 ACTIVITIES":STOP
```

Data Input: The user is requested to input one activity (start node, end node, duration) at a time; at the same time the EST and LFT array elements for these nodes are initialized to zero (this may be unnecessary in many systems but is a good programming habit). Notice that the program will not accept a start node number that is not less than the end node number for that activity.

```
50 FOR I=1 TO N
60 PRINT "ACTIVITY";I:INPUT "FROM,TO,DURATION";N1,N2,D(I)
70 IF N2<=N1 THEN PRINT "START NODE NOT LESS THAN END NODE":GOTO 60
80 E(N1)=0:E(N2)=0:L(N1)=0:L(N2)=0
90 S(I)=N1: F(I)=N2
100 NEXT I
```

EST Computation: The EST of the initial node has already been set to zero; every other node is set by stepping through the activities, setting the EST of the end node equal to the most recently computed event time if it is greater than any previously computed event time for that node.

```
105 C1=0:C2=0:C3=0
110 FOR I=1 TO N: M1=E(S(I))+D(I)
120 IF E(F(I))<=M1 THEN E(F(I))=M1
130 NEXT I
```

Computation of LFT: Initially, the LFT of the terminal node is set equal to its EST. Then stepping backwards through the activities, the LFT of each start node is set equal to whichever is smaller: the most recently computed event time or a previously computed event time for that node.

```
140 L(F(N))=E(F(N))
150 FOR I=N TO 1 STEP -1: L1=S(I)
160 M2=L(F(I))-D(I)
170 IF L(L1)>=M2 OR L(L1)=0 THEN L(L1)=M2
180 NEXT I
```

Float Time: The float time of each activity is computed by subtracting the EST of its start node and the duration of the activity from the LFT of its end node. A count is kept of the number of activities having a zero float.

```
190 FOR I=1 TO N: F1(I)=L(F(I))-E(S(I))-D(I)
200 IF F1(I)=0 THEN C1=C1+1
210 NEXT I
```

Output: The results computed so far are printed in table form.

```
220 PRINT: PRINT "CP ANALYSIS IS:"
230 PRINT : PRINT "FROM","TO","EST","LFT","FLOAT":PRINT
240 FOR I=1 TO N
250 PRINT S(I),F(I),E(S(I)),L(F(I)),F1(I)
260 NEXT I
```

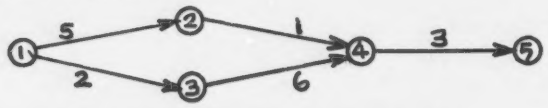
CP computation: The length of the critical path is computed by finding the largest LFT; starting with the first activity with a zero float time and using each end node as the next start node, the numbers along one critical path are printed. If the number of nodes in the path is not the same as the number of activities with a zero float, then there is more than one critical path.

```
265 FOR I=1 TO N
270 IF L(F(I)) > C3 THEN C3=L(F(I))
275 NEXT I
280 PRINT "THE CRITICAL PATH LENGTH IS ";C3
290 PRINT:PRINT "THE CRITICAL PATH IS:":PRINT "FROM","TO":PRINT
300 FOR I=1 TO N:IF F1(I)=0 THEN 320
310 NEXT I
320 PRINT S(I),F(I): C2=C2+1: IF I > N THEN 350
330 FOR J=1 TO N: IF S(J)=F(I) AND F1(J)=0 THEN I=J: GOTO 320
340 NEXT J
350 IF C1 <> C2 THEN PRINT "THERE IS MORE THAN ONE CRITICAL PATH"
360 END
```

Here is a complete listing of the program. If it is not already available on your system, this is a good time to either brush up on your typing or enlist the help of the prize typist in your group.

```
5 REM CRITICAL PATH ANALYSIS
10 DIM S(20),F(20),D(20),E(20),L(20),F1(20)
20 PRINT "CRITICAL PATH ANALYSIS":PRINT
30 INPUT "NUMBER OF ACTIVITIES";N
40 IF N > 20 THEN PRINT "LIMIT IS 20 ACTIVITIES":STOP
50 FOR I=1 TO N
60 PRINT "ACTIVITY";I:INPUT "FROM,TO,DURATION";N1,N2,D(I)
70 IF N2<=N1 THEN PRINT "START NODE NOT LESS THAN END NODE":GOTO 60
80 E(N1)=0:E(N2)=0:L(N1)=0:L(N2)=0
90 S(I)=N1: F(I)=N2
100 NEXT I
105 C1=0:C2=0:C3=0
110 FOR I=1 TO N: M1=E(S(I))+D(I)
120 IF E(F(I))<=M1 THEN E(F(I))=M1
130 NEXT I
140 L(F(N))=E(F(N))
150 FOR I=N TO 1 STEP -1: L1=S(I)
160 M2=L(F(I))-D(I)
170 IF L(L1)>=M2 OR L(L1)=0 THEN L(L1)=M2
180 NEXT I
190 FOR I=1 TO N: F1(I)=L(F(I))-E(S(I))-D(I)
200 IF F1(I)=0 THEN C1=C1+1
210 NEXT I
220 PRINT: PRINT "CP ANALYSIS IS:"
230 PRINT : PRINT "FROM","TO","EST","LFT","FLOAT":PRINT
240 FOR I=1 TO N
250 PRINT S(I),F(I),E(S(I)),L(F(I)),F1(I)
260 NEXT I
265 FOR I=1 TO N
270 IF L(F(I)) > C3 THEN C3=L(F(I))
275 NEXT I
280 PRINT "THE CRITICAL PATH LENGTH IS ";C3
290 PRINT:PRINT "THE CRITICAL PATH IS:":PRINT "FROM","TO":PRINT
300 FOR I=1 TO N:IF F1(I)=0 THEN 320
310 NEXT I
320 PRINT S(I),F(I): C2=C2+1: IF I > N THEN 350
330 FOR J=1 TO N: IF S(J)=F(I) AND F1(J)=0 THEN I=J: GOTO 320
340 NEXT J
350 IF C1 <> C2 THEN PRINT "THERE IS MORE THAN ONE CRITICAL PATH"
360 END
```

Here is a sample run of program CP, using the network below. The arcs are labeled with the duration of the activity and the events have been numbered with start node less than end node.



The program then prompts for the input data:

```
RUN
CRITICAL PATH ANALYSIS

NUMBER OF ACTIVITIES? 5
ACTIVITY 1
FROM,TO,DURATION? 1,2,5
ACTIVITY 2
FROM,TO,DURATION? 1,3,2
ACTIVITY 3
FROM,TO,DURATION? 2,4,1
ACTIVITY 4
FROM,TO,DURATION? 3,4,6
ACTIVITY 5
FROM,TO,DURATION? 4,5,3
```

Notice that the node numbers *must* be input in increasing order.

And then prints out the results:

Earliest Start Time of "From" Node

Latest Finishing Time of "To" Node

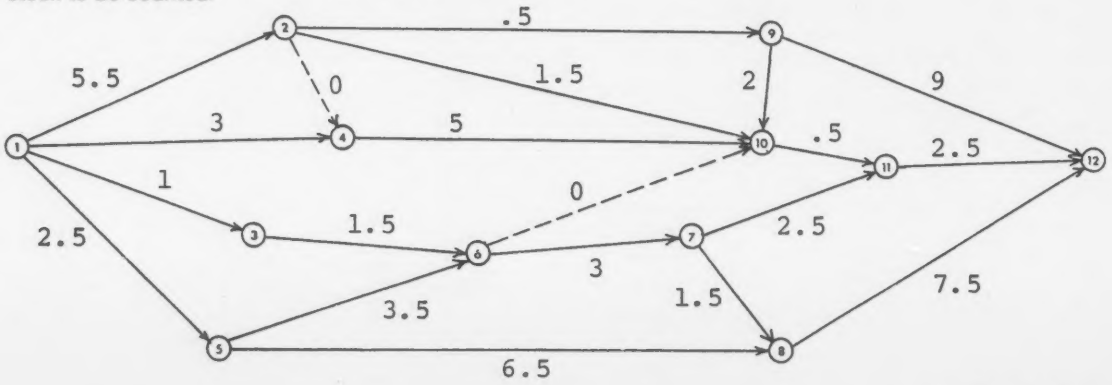
```
CP ANALYSIS IS:

FROM          TO          EST          LFT          FLOAT

 1            2            0            7             2
 1            3            0            2           * 0
 2            4            5            8             2
 3            4            2            8           * 0
 4            5            8           11           * 0
THE CRITICAL PATH LENGTH IS  11

THE CRITICAL PATH IS:
FROM          TO
 1            3
 3            4
 4            5
```

Longest Path

Critical* Activities

PROBLEMS:

1. Test the CP Program with the data from the room decorating problem on page 90. If you have not already worked through this problem with pencil and paper, the task descriptions 1 and 2 will be of help in getting the data into the correct form for program input.
2. The stock manager of a large grocery store has organized her personnel to take stock in time for her to prepare a report for the director's meeting. The following network shows her basic plan; the arcs indicate the time she has estimated for each section of stock to be counted:



A. How long will stock taking require?
B. The manager of the order department has offered her the services of a few of his personnel if she needs them. During which activities would you advise her to use these extra resources?

3. A house construction project can be broken down into the following activities:

NAME	DESCRIPTION	IMMEDIATE PREDECESSORS	TIME (DAYS)
a	Excavate, pour footers	—	4
b	Pour concrete foundations	a	2
c	Erect frame and roof	c	4
d*	Lay brickwork	b	6
e	Install drains	e	1
f	Pour basement floor	e	2
g	Install rough plumbing	e	3
h*	Install rough wiring	c	2
i*	Install air conditioning	c,f	4
j*	Fasten plaster & plaster board	g,h,i	10
k	Lay finished flooring	j	3
l**	Install kitchen equipment	k	1
m**	Install finished plumbing	k	2
n**	Finish carpentry	k	3
o	Finish roofing & flashing	d	2
p	Fasten gutters & downspouts	o	1
q	Lay storm drains	b	1
r*	Sand & varnish floors	n,s	2
s	Paint	l,m	3
t*	Finish electrical work	s	1
u	Finish grading	p,q	2
v	Pour walks, & landscape	u	5

* Indicated those jobs with some, but not all, of their immediate predecessors in common.
** Indicates those jobs with all their immediate predecessors in common.

Task 1: Draw a network from the predecence table, inventing dummies as necessary to express the relationships.

Task 2: Now number the nodes so that each activity can be uniquely named by a pair (start node end node).

Task 3: If you have more than 20 activities, alter CP to handle the increased size of your network.

Task 4: From your CP analysis, write a report for the housing contractor indicating the length of the process, what the critical activities are, what the float times are for non-critical activities.

PROJECTS:

1. After program CP has printed out the analysis, it would be useful to be able to alter some of the durations and then rerun the analysis without having to re-enter all the activities. Here are some suggestions for steps to include in your adapted version of the program to implement this idea:
    1. Does the user wish to alter some durations or not?
    2. How does the user indicate the activities to be altered and their durations?
    3. How does the user indicate that he is finished making changes?
    4. Are all necessary variables re-initialized (can you use some existing code to do this)?
2. If you were reduced to using your toes and fingers to achieve the correct ordering scheme for the nodes in the house construction problem, then you can imagine numbering a network with a few thousand activities! What are the implications of letting the computer program come up with the correct numbering (and check for network well-formedness at the same time). Consider first what the present version of CP does *not* do:
    - — check for valid durations
    - — check for valid node numbers (it assumes that they are greater than zero but less than 21)
    - — check that the activities are entered in numerically ascending order by start node and by end node within start node
    - — check for unique activity names
    - — check for unique initial and terminal nodes:

To make all these changes at one time would be a formidable task. Instead, try your hand at implementing the first few, making one set of changes at a time. Be sure that one improvement works before going on to the next. ■

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Timothy C. Craven

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Basically, the NEPHIS program takes a single input record worked out by you as indexer and produces from it a whole set of entries for your index. The input record contains a short description of the subject of one of the items you want to index. This description is usually just ordinary English with a few tagging characters added to tell the program what to do with it. The only other element you need in the input record is some sort of identification to show which item the description refers to.

When the program has finished with the whole file of input records, all you have to do is use a standard sort routine on the resulting file of index entries and you have your index. Of course, you can go on to write another program to reformat the index the way you want it to look (divide it into pages, number the pages, put the entries in justified columns, etc.)

The original version of the NEPHIS program was in assembly language, but the version illustrated here is an adaptation to BASIC, with a view to its use on small systems. This BASIC program was implemented on a DECsystem 10, but it was designed to be as machine-independent as possible. It does not assume that your version of BASIC has character string manipulation (though string vectors *are* assumed).

Each logical input record is made up of a series of character strings, the last of which must be a slash (/). BASIC should treat each of these strings as a "record" from its point of view and assign each to a different location in the vector I$.

"NEPHIS" is of course an acronym, standing for "NEsted PHrase Indexing System." "Nesting" is indicated in the

Timothy C. Craven, School of Library and Information Science, The University of Western Ontario, London, Ontario, Canada N6A 5B9.

File of input records

```
copy input>tty:
Research Productivity ? of < Sleep Researchers > . #1
/
US Patent Office Classification ? < ? Classification Schemes - > . #2
/
Automatic < Indexing > . #3
/
Equations ? for < ? Design ? of < Retrieval Systems > > . #4
/
Forecasts ? on < Publication ? in < Science > > . #5
/
Metalanguages ? for < Communications Research ? . Techniques - > . #6
/
Information Science ? & < Operations Research ? & > . #7
/
```

File of entries produced

```
copy perm>tty:
Research Productivity of Sleep Researchers . #1 /
Sleep Researchers . Research Productivity . #1 /
US Patent Office Classification . #2 /
Classification Schemes - US Patent Office Classification . #2 /
Automatic Indexing . #3 /
Indexing . Automatic - . #3 /
Equations for Design of Retrieval Systems . #4 /
Retrieval Systems . Design . Equations . #4 /
Forecasts on Publication in Science . #5 /
Publication in Science . Forecasts . #5 /
Science . Publication . Forecasts . #5 /
Metalanguages for Communications Research . #6 /
Communications Research . Techniques - Metalanguages . #6 /
Information Science & Operations Research . #7 /
Operations Research & Information Science . #7 /
```

Index

```
.typ sorted.dat
Automatic Indexing . #3 /
Classification Schemes - US Patent Office Classification . #2 /
Communications Research . Techniques - Metalanguages . #6 /
Equations for Design of Retrieval Systems . #4 /
Forecasts on Publication in Science . #5 /
Indexing . Automatic - . #3 /
Information Science & Operations Research . #7 /
Metalanguages for Communications Research . #6 /
Operations Research & Information Science . #7 /
Publication in Science . Forecasts . #5 /
Research Productivity of Sleep Researchers . #1 /
Retrieval Systems . Design . Equations . #4 /
Science . Publication . Forecasts . #5 /
Sleep Researchers . Research Productivity . #1 /
US Patent Office Classification . #2 /
```

Program Listing

```
10 REM     THIS PROGRAM PRODUCES A FILE OF
20 REM     PERMUTATIONS FROM A FILE OF INPUT RECORDS.
30 REM     INPUT RECORDS ARE LIKE NEPHIS INPUT STRINGS, EXCEPT THAT
40 REM     SPECIAL CHARACTERS MUST BE SET OFF BY DELIMITERS AND EACH
50 REM     RECORD IS TERMINATED BY A STRING CONSISTING OF A
60 REM     SLASH.
70 DIM I$(30)
80 REM     I$ IS A STRING VECTOR CONTAINING THE INPUT RECORD.
90 DIM S(5)
100 REM     THE DIMENSION OF S DETERMINES THE DEPTH OF NESTING PERMITTED.
110 FILES INPUT, PERM
```

NEPHIS con't...

input record by angular brackets (< and >), appearing as separate strings. Example #3 shows the simplest kind of use of these tags. Note how the tags disappear in the entries produced and how the program generates a dash to show the place where the word "Indexing" is omitted in the inverted form "Indexing . Automatic - . #3".

The question mark (?), appearing as a separate string, suppresses a connective word or phrase, such as a preposition, in certain of the entries while keeping it in others. Example #1 illustrates one use of the question mark. Note how the preposition "of" disappears in the inverted entry "Sleep Researchers. Research Productivity .#1". (The questions mark also has the effect of preventing the program from generating a dash.)

Another use of the question mark is illustrated by #6. Note how the part reading ".Techniques - " appears only in the second entry produced, when the nested phrase which it terminates begins the entry.

Example #5 shows how one phrase can be nested inside a phrase which is itself nested within a third phrase. Note how this affects the order of elements in the three entries produced. Compare the order when the nesting is done "in parallel," as in

Rescue ? of Dogs ? by Children .#8

which gives the entries

Rescue of Dogs by Children . #8
Dogs . Rescue by Children . #8
Children . Rescue of Dogs . #8

Normally, there will be one entry for the whole input record and an additional entry for every nested phrase. But the string "@" can be used to override this provision. For example, in #4 there is no entry produced for "Design of Retrieval Systems," because this phrase has been tagged with "@" in the input record.

Examples #2 and #7 show a couple of special tricks which can be used by the experienced indexer. The beginner is advised to stick as much as possible to simple nouns and prepositions. In any case, the results will be better if you standardize the words you use in describing your subjects.

Bibliography

NEPHIS: A Nested-Phrase Indexing System, by Timothy C. Craven, Journal of the American Society for Information Science, March 1977, p 107. ■

```
120 SCRATCH #2
130 MARGIN #2, 132
140 REM     THE FOLLOWING SECTION READS IN AN INPUT RECORD AND CHECKS FOR
150 REM     LOGICAL ERRORS.
160 IF END #1, GOTO 1310
170 LET S(1)=0
180 LET Q=0
190 LET N=0
200 LET L=0
210 IF END #1, GOTO 550
220 INPUT #1, C$
230 LET N=N+1
240 LET I$(N)=C$
250 IF N=30 GOTO 570
260 IF C$<>"<" GOTO 300
270   LET L=L+1
280   IF L>5 GOTO 590
290   LET Q=0
300 IF C$<>">" GOTO 340
310   LET L=L-1
320   IF L<0 GOTO 610
330   LET Q=0
340 IF C$<>"?" GOTO 360
350   LET Q=1
360 IF C$<>"/" GOTO 210
370 IF Q=1 GOTO 400
380 IF L<>0 GOTO 420
390 GOTO 630
400 PRINT "% '?' NOT FOLLOWED BY '<' OR '>'"
410 IF L=0 GOTO 430
420 PRINT "% NUMBER OF '<'S DOES NOT MATCH NUMBER OF '>'S"
430 PRINT "% INPUT RECORD REJECTED:"
440 FOR M=1 TO N-1
450 PRINT I$(M); " ";
460 NEXT M
470 PRINT C$; " ";
480 IF C$="/" GOTO 520
490 IF END #1, GOTO 550
500 INPUT #1, C$
510 GOTO 470
520 PRINT
530 PRINT
540 GOTO 160
550 PRINT "% LAST INPUT RECORD MISSING FINAL '/'"
560 STOP
570 PRINT "% TOO MANY ELEMENTS IN INPUT RECORD"
580 GOTO 430
590 PRINT "% NESTING TOO DEEP"
600 GOTO 430
610 PRINT "% '>' WITHOUT CORRESPONDING '<'"
620 GOTO 430
630 REM     THE FOLLOWING SECTION PRODUCES THE PERMUTATIONS.
640 LET L=0
650 FOR N=0 TO 29
660 REM     LOOKING FOR THE BEGINNING OF THE NEXT PERMUTATION
670 IF N=0 GOTO 730
680 LET C$=I$(N)
690 IF C$="<" GOTO 730
700 IF C$<>">" GOTO 1290
710 LET L=L-1
720 GOTO 1290
730 LET L=L+1
740 LET S(L)=N
750 IF I$(N+1)="@" GOTO 1290
760 REM     BEGIN PERMUTATION
770 LET D=L
780 LET C=L
790 LET M=N
800 LET B=N
810 LET M=M+1
820 LET C$=I$(M)
830 IF C$="<" GOTO 900
840 IF C$=">" GOTO 970
850 IF C$="?" GOTO 1030
860 IF C$="@" GOTO 810
870 IF C$="/" GOTO 1270
880 PRINT #2, C$; " ";
890 GOTO 810
900 REM     BEGINNING OF A PHRASE
910 IF M=B GOTO 940
920 LET C=C+1
930 GOTO 810
940 PRINT #2, "- ";
950 LET M=E
960 GOTO 810
970 REM     END OF A PHRASE
980 IF C=D GOTO 1010
990 LET C=C-1
1000 GOTO 810
1010 PRINT #2, ". ";
1020 LET C=C-1
1030 LET E=M
1040 LET B=S(D)
1050 LET D=D-1
1060 LET M=S(D)
1070 GOTO 810
1080 REM     CONNECTIVES
1090 LET H=M+1
1100 LET M=M+1
1110 LET C$=I$(M)
1120 IF C$="<" GOTO 1150
1130 IF C$=">" GOTO 1190
1140 GOTO 1100
1150 REM     FORWARD-READING
1160 IF M=B GOTO 950
1170 GOSUB 1230
1180 GOTO 920
1190 REM     BACKWARD-READING
1200 IF C<>D GOTO 990
1210 GOSUB 1230
1220 GOTO 1020
1230 FOR H=H TO M-1
1240 PRINT #2, I$(H); " ";
1250 NEXT H
1260 RETURN
1270 REM     END OF PERMUTATION
1280 PRINT #2, "/"
1290 NEXT N
1300 GOTO 160
1310 END
```

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CS-4001. Space Games-1. Four color-graphics programs for your Apple, including **Rocket Pilot** an advanced lunar lander simulation in which you guide your spacecraft over the mountain to a safe landing on the opposite side. In **Saucer Invasion**, you protect the earth by shooting down the alien invasion fleet with your missile launcher. In **Star Wars**, you line up the Tie fighters in your sights and fire before they get away. **Dynamic Bouncer** is a color graphics demonstration program for your Apple which fills the screen with colored walls that appear and disappear at random, while a ball bounces around within. $7.95.

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CS-4003. Strategy Games-1. Play **Checkers*** in color against the Apple. **Skunk** is a dice game for one or two players. **UFO** is a space game in which you must outwit an enemy spaceship. **Blockade** with exciting graphics and sound effects, with a one or two player option. **Genius,** a challenging trivia quiz. *Requires Applesoft BASIC. $7.95.

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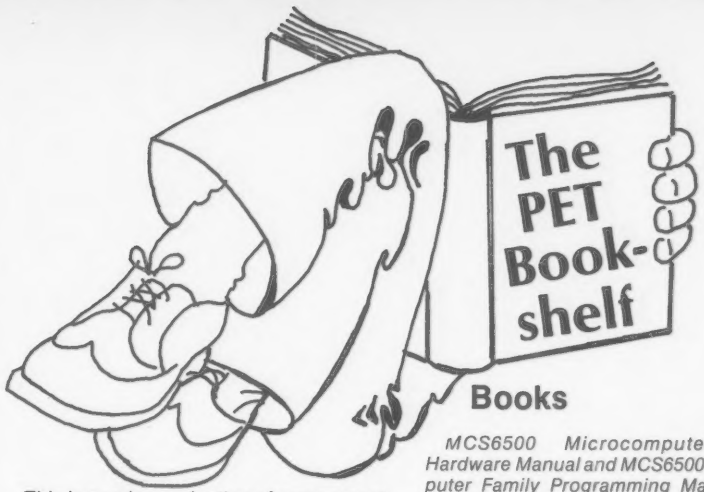


Books

This is a review and rating of some recent publications of interest to Commodore PET owners. Many of the items are also valuable for users of other 6502-based systems; a few are of even broader appeal.

Periodicals

People's Computers, 1263 El Camino Real, Box E, Menlo Park, CA 94025 (bimonthly, $1.50; $8/year; 64 pages, 8½x11"). Contains approximately 4 pages specifically on the PET per issue. Other features are articles on languages, games, equipment reviews and educational uses of computers. Several useful programs are given every issue. Level varies from near-introductory to moderately advanced. Rating: A.

Pet User Notes, P.O. Box 371, Montgomeryville, PA 18936 (bimonthly, $5/year; approximately 16 pages, 5½x8½") is published by Gene Beals' "PET User Group." The first two issues contained a wealth of useful information: rumors about Commodore, hardware and software hints, good programs, etc. Level is intermediate to moderately advanced. If publication continues on schedule (always a danger of problems with new journals) it will be a real winner. Rating: A-.

MICRO, The 6502 Journal, 8 Fourth Lane, So. Chelmsford, MA 01824 (bimonthly, $1.50; $6/year; 30-40 pages, 8½x11") is largely KIM-oriented, but has been running several pages for PET, APPLE, CHALLENGER and other 6502 system owners. Contains some good stuff for machine-language experienced and hardware-builder types. Not much for beginners or BASIC-only folk. Seems to be solidly established; prints interesting ads and a good bibliography of recent publications concerning the 6502. Rating: A-.

The PET Paper, Box 43, Audubon, PA 19407 ($2/issue; $15 for 10 issues (one year)—subscriptions "will not span two volumes," that is, issues 1-10 are a unit; issue 1 had 24 pages, 5½x8½") may improve with age, but the first issue (March 1978) seemed to be mainly fillers. There was a 5-page "Intro to BASIC" article for absolute beginners and 4 pages on "Teaching your PET to bark" which is useful for apprentice builders. If the magazine's software exchange/program library features get going, and if the quality of articles improves, it could be a worthwhile investment. The next few issues should tell. Rating: too early to call.

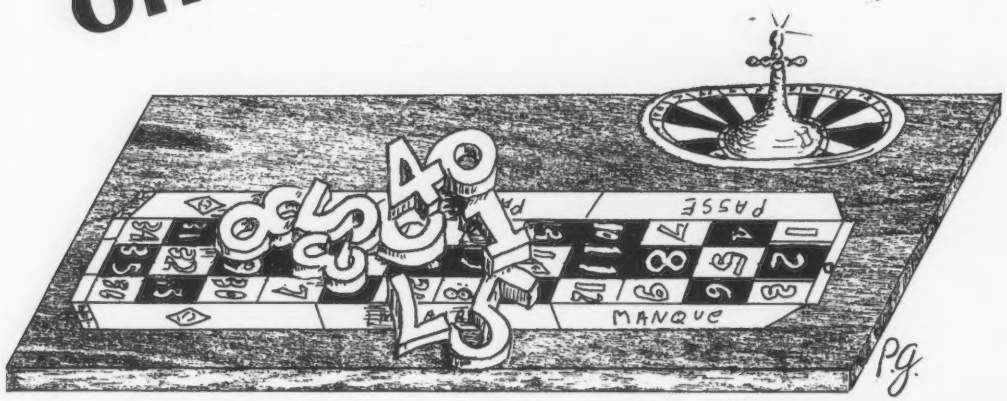
MCS6500 Microcomputer Family Hardware Manual and MCS6500 Microcomputer Family Programming Manual, MOS Technology, Inc., 950 Rittenhouse Road, Norristown, PA 19401 ($7.50 to $10, depending on distributor) are 150-200 page books by the manufacturer of the 6502. Both are extremely well written. The programming manual, in fact, is almost a self-contained course on machine-language programming. Neither volume is of much use for a beginner or BASIC-only programmer: both are essential for hardware or software freaks. Rating: A+ (with the reservations).

How To Program Microcomputers, by William Barden, Jr., Howard W. Sams & Co., Inc., 4300 West 62nd St., Indianapolis, IN 46268 ($8.95) is a moderately good guide to assembly-language programming. Some ideas (binary numbers, microcomputer arithmetic, system architecture and data codes, for example) are discussed in great detail. Others, such as addressing modes, instruction sets and I/O are given only brief coverage, with the excuse that many examples will follow. The examples do follow, but they're sometimes hard to understand without background from other sources. Barden simultaneously discusses 8080, 6800 and 6502 chips. Therefore, the audience for the book is large, but the treatment of the separate families of microprocessors is sometimes hurt. In particular, the 6502 programs given as examples often seem to have been written last, and fail to take advantage of the special abilities of that chip. Many of those programs could be made significantly shorter and faster by someone more at home with 6502 programming.

In spite of these criticisms, the book contains several dozen very useful routines for the beginning 6502 machine-language programmer: list processors, sorters, multiple-precision arithmetic algorithms and more. It's worth the cover price for those alone. Rating: B.

PROGRAMMING A MICROCOMPUTER: 6502, by Caxton C. Foster, Addison-Wesley Publishing Co., Reading, MA ($8.95) is a volume in the "Joy of Computing" series! It teaches machine-language programming from the ground up, with a clear, attractive and amusing style. The book is structured around the KIM, but is quite applicable to PET, APPLE, CHALLENGER and other larger systems. There are chapters on codes and cryptography, music generation, a tiny assembler and a lot more. The hardware experience and expense required is minimal. Overall, it's a delightful way to take the first steps beyond BASIC. Rating: A+. ■

Random Thoughts on RND



Thomas N. Ronayne

Have you ever noticed that when you play a computer game that the initial goal bounds (or distances to goal, or distance between players, or whatever) are always the same on the first play? Have your Monte Carlo method probability studies always resulted in approximately the same outcomes? Do your play results during the course of a game seem to follow a repetitive pattern, game after game?

Well, gang, hold your head up high: it's not just your imagination, there's a reason for these things to happen.

Odds are that you are writing your games or probability studies using one of the handier functions of the BASIC programming language, RND. RND is intended by the friendly folks that write software as a convenient source of uniform random numbers: uniform random numbers that are, within finite limits, random, non-repeating, and evenly distributed from just above zero to just below one. They are very handy when doing coin-toss studies, testing sort routines, making probability studies, and creating and playing games.

All random numbers generated by a computer (or any other mechanical, electromechanical, or electronic — like a calculator — device) are the results of the output of a program. The BASIC function, RND, used in a series of BASIC program statements merely calls out of memory a program (an action similar to a subroutine call) and executes it to provide a random number. Should a computer programmer be interested, it is, of course, entirely possible to write a routine that will perform the same task. But, other than just for the sake of intellectual exercise, why bother? (Don't take my word for it, get a copy of the Texas Instruments SR-52 Statistics Library for their program for generating uniform random numbers; if that doesn't discourage all but the most dedicated "computer freak," I'll eat my hat). If you are aware of the limitations imposed on you by some of the hardware/software vendors, the simple function RND is far more acceptable and a whole lot easier.

There are a great many ways of testing the RND function for repetitiveness, randomness, and uniformity: probably as many as there are programmers using RND. You can, for example, use frequency distribution programs, you can test each element of a random table against each other element, you can test with sort routines, etc. This treatise is not an attempt to get into the foggy world of huge tables and cross-checking, it is rather an attempt to point out one of the great fallacies of computers and computing: ya can't always trust 'em, guys.

Each of us is somewhat imprinted with the knowledge that computers are never wrong. Generally, that's true. But, and this is a very big *but*, they aren't always right either. They have limitations, and software writers have built-in prejudices just like the rest of us.

What all this verbiage does is bring us back to the initial question: why do initial settings using random-number generators seem to repeat?

When repetitiveness seems to occur, it is not because the random numbers generated by the function RND are repetitive, or non-random, or non-uniform. It is because the *table* or *sequence* of randomly generated numbers repeats! That is, every time you generate a table of random numbers from a "cold" (the RUN command) start, the table repeats. Figure 1 details a brief program, followed by six tables of random numbers generated by the program. Note that each table is an exact duplicate of the others. Figure 2, on the other hand, lists almost the same program, followed by six tables of random numbers generated by the program; each different from the others. It is stated

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without proof that both programs generate evenly distributed non-repeating tables of random numbers when large volumes of the output of both Figure 1's program and Figure 2's program are closely examined.

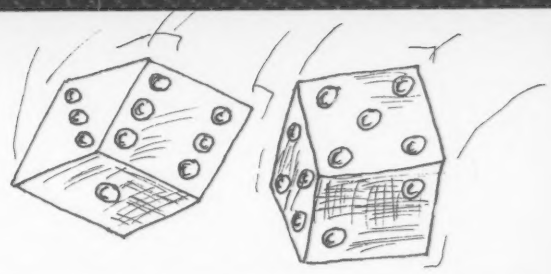

FIGURE I

```
ready
*10 FOR I = 1 TO 10
*20 A = RND(X)
*30 PRINT A;
*40 NEXT I
*RUN

   .7886751    .5277669    .8706056    .0968034    .2763165  .433508
   .7112102  .534787     .7761967    .9180544

ready
*RUN

   .7886751    .5277669    .8706056    .0968034    .2763165  .433508
   .7112102  .534787     .7761967    .9180544

ready
*RUN

   .7886751    .5277669    .8706056    .0968034    .2763165  .433508
   .7112102  .534787     .7761967    .9180544

ready
*RUN

   .7886751    .5277669    .8706056    .0968034    .2763165  .433508
   .7112102  .534787     .7761967    .9180544

ready
*RUN

   .7886751    .5277669    .8706056    .0968034    .2763165  .433508
   .7112102  .534787     .7761967    .9180544

ready
*RUN

   .7886751    .5277669    .8706056    .0968034    .2763165  .433508
   .7112102  .534787     .7761967    .9180544
```

FIGURE II

```
*LIST

10 FOR I = 1 TO 10
20 A = RND(-1)
30 PRINT A;
40 NEXT I

*RUN

   .1246126    .8637044    .2065431    .4327409  .612254    .7694455
   .0471477    .8707245    .1121342    .2539919

ready
*RUN

   .9410189    .1801107    .0229494    .7491472  .4286603   .0858518
   .8635539    .1871307    .9285405    .5703982

ready
*RUN

   .8707064    .1097982    .9526369    .6788347  .3583478   .0155393
   .7932414    .1168182  .858228     .5000857

ready
*RUN

   .8003939    .0394857    .8823244    .6085222  .2880353   .9452268
   .7229289    .0465057    .7879155    .4297732

ready
*RUN

   .4175814    .6566731    .4995119    .2257097  .9052228   .5624143
   .3401164    .6636932  .405103     .0469607

ready
*RUN

   .1011731    .8402669    .1831056    .4093034  .5888165  .746008
   .0237102  .847287     .0886967    .2305544
```

Most basic BASIC books instruct a student of the language to generate random numbers by utilizing a statement similar to that of line 20 in Figure 1; that is,

20 LET A = RND(X)

Needless to say, that particular usage has a tendency to become imprinted in the mind of the student, and he learns it as "the way" to generate random numbers forever and ever. In most cases, and on some machines, it serves the user well for the remainder of a programming career. Now comes the rub: the outputs listed in Figures 1 and 2 were produced by Honeywell Series 6000 BASIC software (which is not exactly sluff stuff), on a pretty sophisticated piece of hardware. (Remember that line about blind trust?) The obvious query is, of course, why?

Programs that generate random numbers may be very easily compared to the process of farming. A farmer plants a seed, the seed grows into a plant that is ultimately harvested. Similarly, a computer program spews out numbers from a "seed" in the program (a random-number program has to start somewhere!) It must, like a plant, have a seed to grow from. In the normal course of following what was initially imprinted in the mind, the programmer seeds his random number generator

20 LET A=RND(X)

and presupposes that he will receive a nice harvest of uniform random numbers.

Normally, that's exactly what happens, but our programmer may, like the example of Figure 1, get the same table every time he runs the program.

You should have noticed by now that X is the seed. In reality, it doesn't matter what the seed is (Y, A, B, or whatever), the table produced by RND( ) will repeat whenever generated from a cold (RUN) start. That's also why you always start a game at, say. 789 yards to target.

Fortunately, there is a way around this "seeding" conundrum; like many solutions to sticky problems, it is extremely simple: seed with a negative, odd integer, as

20 LET A=RND(-1)

This is not to say that taking such action will *guarantee* non-repeating tables; I have run a great many separate tables and have never seen a repeat, but cannot state for sure that it doesn't happen. I've just never seen it.

Figure 2 is the result of utilizing exactly the same program as that of Figure 1, with the exception of the seed.

Again, there are as many ways of generating random numbers as there are hardware designers, software designers, and design committees. Some, for example, use the clock, some the date, some the time of day, some the processor time. Your software may use one of these, or it may use something else entirely. Or, like me, you may share the RND(X) problem with most (if not all) Honeywell users.

Really, the idea of this exercise on a typewriter is an excuse to explore some possibilities in computer game-playing (more specifically, game-writing). Games on computers are fun. They are also educational for the writer. Computers should provide some recreation in life, or they are no better than green-eyeshade clerks in some back office (and those guys ain't no fun nohow).

To be any good at all, games must have options in play. When playing against a computer, the player should never be able to predict any possible outcome of play (that gets awfully boring). And, above all, there should not be *any* uniformity (or chauvinism?) shown by the machine when it chooses its own options or assesses penalties.

For example, write a game that utilizes integers from zero to nine to determine the outcome of play. Something like

```
10 N=INT(RND(-1)* 10)
```

will do nicely. You have just given a player (human or machine) an equal chance of drawing 0, 1, 2, 3, 4, 5, 6, 7, 8, or 9. Remember, random numbers are uniformly distributed: the above example automatically dictates uniformity, which is very chauvinistic, and not a heck of a lot of fun.

Okay, so all that's very nice. How, then, does one get *un*uniform numbers from a device that is purposely designed to be as uniform as possible? Easy, use pi as a multiplier (actually, you can use any fraction tacked onto an integer, even a random fraction, but pi has a certain mysticism attached to it, and why not throw in a little scientific mysticism now and again — impress your friends).

Try this on for size

```
50N=INT(RND(-1)*3.14159+1)
```

now you get 1's, 2's, 3's and 4's. You get approximately evenly distributed 1's, 2's, and 3's (on the order of 31.6666%), but only approximately 5% 4's. This is handy if you really want to sock it to a player with a biggie only about 5% of the time. It makes a game more interesting than an even chance of getting zapped 10% of the time as with INT(RND(-1)*10).

Following is an eleven-equal-class frequency distribution of the statement using pi as a multiplier.

FREQUENCY DISTRIBUTION

CLASS	CLASS BOUNDARIES			FREQ.	REL FREQ.
1	1.000000	UP TO	1.272727	334	33.40
2	1.272727	UP TO	1.545455	0	.00
3	1.545455	UP TO	1.818182	0	.00
4	1.818182	UP TO	2.090909	298	29.80
5	2.090909	UP TO	2.363636	0	.00
6	2.363636	UP TO	2.636364	0	.00
7	2.636364	UP TO	2.909091	0	.00
8	2.909091	UP TO	3.181818	329	32.90
9	3.181818	UP TO	3.454545	0	.00
10	3.454545	UP TO	3.727273	0	.00
11	3.727273	UP TO	4.000000	39	4.40

Of course, the distribution is not exactly 33.6666% for 1, 2, or 3, and 5% for 4. This particular sample is based on a distribution of only 1,000 numbers; however, a much larger (on the order of one million tries) distribution has shown that the percentages shown are approximately those stated.

Now, let's say that you really want to throw in some curves. The statement

```
50 A=INT(RND(-1)*3.14159
+1* (INT(RND(-1)*3.14159+1)))
```

yields up some fairly interesting results:

FREQUENCY DISTRIBUTION

CLASS	CLASS BOUNDARIES			FREQ.	REL FREQ.
1	1.000000	UP TO	1.545455	117	11.70
2	1.545455	UP TO	2.090909	212	21.20
3	2.090909	UP TO	2.636364	0	.00
4	2.636364	UP TO	3.181818	268	26.80
5	3.181818	UP TO	3.727273	0	.00
6	3.727273	UP TO	4.272727	239	23.90
7	4.272727	UP TO	4.818182	0	.00
8	4.818182	UP TO	5.363636	136	13.60
9	5.363636	UP TO	5.909091	0	.00
10	5.909091	UP TO	6.454545	25	2.50
11	6.454545	UP TO	7.000000	3	.80

Again, no predictable results, but using this statement to allow success or to assess penalties can make for some interesting games (7 can be a real whopper, 6 just a bit less, 1 just a bit less, and so on).

Without beating the thing to death with a stick, you get the idea. Vary the possibilities by varying the probabilities, and choose your alternatives as a result of the expected frequency distribution.

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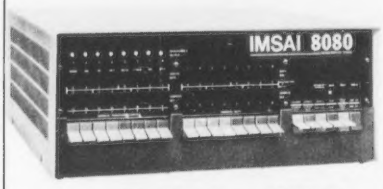

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Now a word or two about odds. Computer games should be designed to set the odds of success or failure for both the human player and the non-human player. Ideally, because the human player has reason on his side, while the non-human player does not, the odds of success and/or failure for the human player should be exactly 50-50, ½, or whatever you prefer. The non-human player, on the other hand, should have a slight edge on his aim, gains, or successes, as well as the inverse: his failure rate should be less than that of the human player, that is, less than 50-50 chances of failing. He, the machine (ever notice that computers are about the only devices in western culture not referred to in the vernacular as "she," like cars, boats, airplanes?), cannot reason, after all, and is only acting as a result of the pre-set conditions that you, the programmer, have set for him. Normally, you'll see something like

```
50 A=INT(RND(-1)*2+1)
```

setting everybody's odds in play. This results in exactly even, 50-50, odds. Fine for the human player who can see where he's going, but not so hot for the machine that determines its play from a random number to begin with...

Give him an edge

```
50 A1 = INT(RND(-1) * 2.14159 + 1)
```

and, because you're going to get them, throw out the 3's that occur

```
60 IF A1 = 3 THEN 50
```

Now you get a distribution that looks like

FREQUENCY DISTRIBUTION

CLASS	CLASS BOUNDARIES	FREQ.	REL FREQ.
1	1.000000 UP TO 1.090909	531	53.10
2	1.090909 UP TO 1.181818	0	.00
3	1.181818 UP TO 1.272727	0	.00
4	1.272727 UP TO 1.363636	0	.00
5	1.363636 UP TO 1.454545	0	.00
6	1.454545 UP TO 1.545455	0	.00
7	1.545455 UP TO 1.636364	0	.00
8	1.636364 UP TO 1.727273	0	.00
9	1.727273 UP TO 1.818182	0	.00
10	1.818182 UP TO 1.909091	0	.00
11	1.909091 UP TO 2.000000	469	47.40

Not much of an edge, but an edge nonetheless.

You can also attain interesting results by dividing a random number by a random number and then multiplying by an integer value and then adding a random number to the result and so on. The possibilities are virtually unlimited, but, eventually, the usefulness comes into question.

The whole idea is to get around and away from the automatic uniformity and equal distribution of the RND function, to add some spice to games. If you remember your basic statistics classes, the purpose of random-number schemes is to assure non-structured results in experiments, but insure some uniformity in samples. That's fine for sampling, simulation, and so on, but it's not too great for game playing.

Games are not structured to be played in a uniform fashion, and they aren't really much fun if they are too structured (like Pong, structured games get pretty boring pretty quickly). Games structured around something like INT(RND(-1) * 10) become structured to the very nature of the random number process: a 10% chance of any one option occurring.

Think of it this way. Random-number generators simulate the toss of a fair coin — over the long haul, you get exactly 50% heads, 50% tails.

What fun is that? ■

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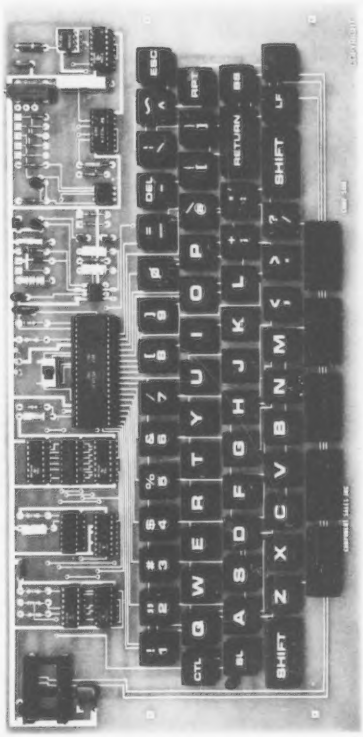

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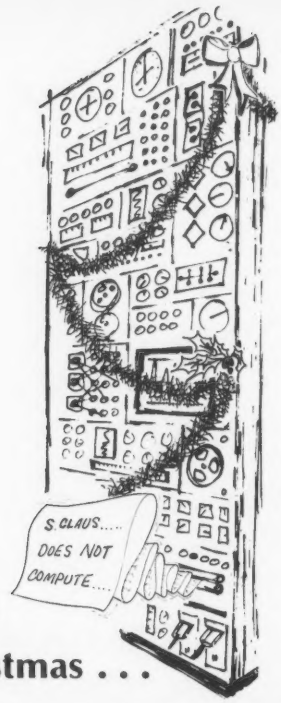

'twas the night before Christmas . . .

T'was the night before Christmas, and all through the shop,
The computers were whirring; they never do stop.
The power was on and the temperature right,
In hopes that the input would feed back that night.
The system was ready, the program was coded,
And memory drums had been carefully loaded;
While adding a Christmasy glow to the scene,
The lights on the console, flashed red, white and green.
When out in the hall there arose such a clatter,
The programmer ran to see what was the matter.
Away to the hallway he flew like a flash,
Forgetting his key in his curious dash.
He stood in the hallway and looked all about,
When the door slammed behind him, and he was locked out.
Then, in the computer room what should appear,
But a miniature sleigh and eight tiny reindeer;
And a little old man, who with scarcely a pause,
Chuckled: "My name is Santa ... the last name is Claus."

The computer was startled, confused by the name,
Then it buzzed as it heard the old fellow exclaim:
"This is Dasher and Dancer and Prancer and Vixen,
And Comet and Cupid and Donner and Blitzen."
With all these odd names, it was puzzled anew;
It hummed and it clanked, and a main circuit blew.
It searched in its memory core, trying to "think";
Then the multi-line printer went out on the blink.

Unable to do its electronic job,
It said in a voice that was almost a sob:
"Your eyes—how they twinkle—your dimples so merry,
Your cheeks so like roses, your nose like a cherry,
Your smile—all these things, I've been programmed to know,
And at data-recall, I am more than so-so;
But your name and your address (computers can't lie),
Are things that I just cannot identify.
You've a jolly old face and a little round belly,
That shakes when you laugh like a bowlful of jelly;
My scanners can see you, but still I insist,
Since you're not in my program, you cannot exist!"

Old Santa just chuckled a merry "ho, ho,"
And sat down to type out a quick word or so.
The keyboard clack-clattered, its sound sharp and clean,
As Santa fed this "data" to the machine:
"Kids everywhere know me; I come every year;
The presents I bring add to everyone's cheer;
But you won't get anything—that's plain to see;
Too bad your programmers forgot about me."
Then he faced the machine and said with a shrug,
"Happy Christmas to all," as he pulled out its plug.

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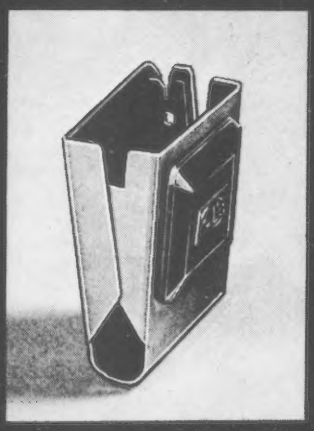

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Games—Not Just For Fun

Unvarnished Truth About KIM?

Jim Butterfield

When we talk about personal computers, we don't mean business or government scale machines. Even the process computers now entering the home cannot be included: the ones that run your microwave oven, automobile, sewing machine or whatever. These built-in devices are not really accessible: they don't give you personal scope or allow you to do your own personal "thing."

Doing your own thing means placing your stamp of individuality on the machine. It must not be locked up on "serious" tasks to the extent that you lose access to it. My own machine is a KIM-1 system which is often thought of as a process control device. Yet if I ask among the community of KIM users, "Are you using KIM to control things? To turn lights on and off? To control temperatures? Detect burglars?" ... the answer is almost always the same, "No; if I did those things, I wouldn't be able to play with it any more." That, I think, is a very sensible answer. Personal computing should be enjoyable.

I sometimes detect a form of Puritan ethic among personal computer users. There seems to be an underlying feeling that there's something wrong with enjoying yourself. It's akin to the unwritten law of tax deductions: they are only allowable if you can prove you didn't enjoy the trip or meal or whatever. It's all too common to hear, "Don't demonstrate games; people won't think you're serious." Yet I, for one, don't want to be thought of as a serious user.

I went through an interesting exercise at a computer display not long ago. I announced that the other hobbyists could be as serious as they liked, but I for one was going to demonstrate something frivolous to the public. My first attempt was one of the simplest programs in existence: a reaction test. When the light comes on, press the button and the display will tell you how long it has taken you. I was told that that was a very good serious display. Despite the number of children gathered around it whooping and thumping the button, and the adult players making side bets, it turned out it was serious and useful. One associate started adding mean and standard deviation statistics into the package so as to make it a physiological tester.

Make up your mind to enjoy your projects. Resolve to grit your teeth and have a good time no matter what.

I wasn't going to be caught being serious, so I changed the display to playing music. That turned out to be a highly serious business; it seems that the generation of various sorts of tones, and arranging to store music in memory with provision for repeated phrases, is a matter of considerable serious interest. I was even shushed when I tried to whistle along with one of my tunes.

I had little hope that a Lunar Lander package would manage to un-serious my display. But I confess to some surprise when asked if my program could be included in a technical paper as an example of the solution of differential equations.

There's probably a moral here, indicating that frivolous things are really serious, and vice versa. It's more important to note that seriousness is a state of mind. Make up your mind to enjoy your projects. Resolve to grit your teeth and have a good time no matter what.

I must confess to amazement at what some people enjoy. I recall a recent conversation with a computer-kit builder that went like this: "...and after I repaired those six defective chips, I plugged the board in wrong, and my power supply blew. It took me two weeks to repair the damage on that one, and then I discovered that noise on my interrupt line was fouling up my programs ... gee, I'm having fun!" He really meant it. I'm sure it will be a letdown when everything works properly.

I've heard it argued that personal-computer fans should be concerned about their public image, that we should avoid fostering the idea of computers as toys. Computers do indeed need some kind of new image. The public must have a rather strange idea of what a computer is, based upon their experiences of incorrect bills, seemingly unchangeable data bases, and very slow responses to queries. Game-playing gives a new view of computers as less impersonal devices. Perhaps the idea will take root that problems are caused not by the machine, but by the way it is used. We need to fight the concept of impersonal computers ... with personal computers.

Games and recreations should not be thought of as trivial things.

There are a number of areas in computing where it's hard to see recreational content. It's hard to visualize a fun income-tax return or an amusing accounting package. Neither process control nor statistical work are thought of as yielding a lot of laughs. I don't think of these as personal; they may be located in your home, but they won't be for your personal use. There will be some personal systems: calendars and date reminders; recipe files; personal inventory files... but unless they can be personalized, they won't be much fun. And if they're not much fun, they will be prone to fall into disuse. The whimsy that created the cuckoo clock is very much needed here.

Games and recreations should not be thought of as trivial things. Games

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Paper originally given at PERCOMP '78, April 29, 1978, Long Beach, CA.

Jim Butterfield, 14 Brooklyn Ave., Toronto, Ontario, M4M 2X5, Canada.

Games Con't. . .

start with children imitating reality. Whether the game is baseball, cops and robbers, or a kitten playing with a string, the object is the same: to imitate and prepare for the real world.

Most people are familiar with various strategy games—war games, financial games, even ecological and sociological games. They can in some respects represent the realities of the outside world. A computer can be an ideal way to simulate reality, whether in a lunar lander where we simulate the dynamics of a craft, or playing an economic game like Hammurabi to see how many people we can starve this year. Each game teaches us something about the real world. In general, the more realistic the game, the more it's enjoyed.

The most advanced form of this type of game is various types of training simulators, where we simulate the operation of an expensive machine and allow people to develop skills by operating this proto-machine. Flight simulators, used by most airlines, are the best known devices of this type. I suspect we'll soon see such devices in the home: they sound like a lot of fun.

Games can be quite useful as a means of testing, both physiological and psychological. Reaction tests, aptitude tests and others can be enjoyable for the subject and informative for the tester. Psychological programs such as ELIZA which can carry on limited conversations are also of interest.

The educational value of games and recreations is evident. Creating the program is in itself a highly instructive experience. This is particularly true because of the scope the programmer has in defining his own system: input, output, timing and overall rules. Commercial-style projects often give little latitude in these areas, and can limit the programmer's "global view." Carrying a program through from concept to implementation, observing its operation and taking it through a rewrite develops a far more profound set of skills than the more common exercise of drawing flowcharts to order.

On the application side of education, computer-assisted instruction (CAI) is well known in the classroom. Now it can reach the home in a much more direct form: teaching programs, drills and exercises which can be paced to the student and matched to his own specific areas of interest.

Games and recreations are of course a field of study in themselves. Game theory defines a number of classes of games; and within the framework of the personal computer we may need to add new classifications. There are games that the computer referees, and games in which it is a player. As a player, the computer can use strategies which are fixed, randomized, or adaptive. One simple scheme is to give the computer an IQ or handicap, allowing it to play at a level that matches its human opponent. It's not a game unless it's interesting, and games in which the computer always wins or always loses are equally dull.

Games and recreations can serve as motivating devices where they provide new resources or new mechanisms. This is probably most noticeable in the world of the arts. The advent of personal computers may herald a new wave of cultural activities in the home. Perhaps some computer-based systems will be thought of in terms of works of art. They require creative skills from several disciplines, and are often designed to influence the awareness of other humans.

The field of computer-generated art has been making progress for many years, and as better low-cost input-output devices become available, it will continue to improve. Computer-generated music is already popular with hobbyists on several fronts, particularly in sound synthesis and as an aid to composition. (*Creative Computing,* Mar/Apr '78). Also computer generation of dance routines. (*Creative Computing,* Mar/Apr 77).

The artist is discovering more and more resources which computer technology is making available. Personal computing can provide these resources in the home. Can we look forward to a computer-cultural renaissance? (*Creative Computing,* May/Jun '78) and *Artist and Computer.*)

I find games an excellent way to introduce computers and computing techniques to others. Visitors to exhibits or trade shows often have difficulty relating to what they see. An accountant doesn't want to see a process-control package; a statistician won't be interested in a text editor; a physicist will see little of value in an accounts receivable program. But they will all like games. Strangely enough, they will all be able to relate what they see in games to their own applications, identifying the suitability of inputs, outputs, and storage media in terms of their own needs. One of the objects of the many games in "The First Book of KIM" is to provide the resources to build your own application: if you need a certain kind of input or output routine, chances are it will in there somewhere. Even active hobbyists often use games as their benchmark of computer excellence. Sometimes I wonder if STAR TREK will become an industry-standard benchmark program.

Sometimes I wonder if STAR TREK will become an industry-standard benchmark program.

To sum up: perhaps I may not have convinced you that games should be taken seriously (!). But there's at least one more factor to consider. Games and recreations—so-called "frivolous" applications—have given real impetus to the personal-computer industry and to electronics in general. Personal computers, video games, and calculators—which are more often used in fun than in earnest—have created a new industry and have produced remarkably low-price structures.

So the next time you're caught fooling around with some non-serious activity on your personal computer, you can explain that you're not just having fun; you're helping found a new technology. ■

AN EXPERIMENT IN TEACHING STRATEGIC THINKING

J. M. Brady and R. B. Emanuel

1. Introduction

In his influential article (4) on LOGO education, Seymour Papert has discussed several ideas regarding the application of computing technology to enhance education under three broad headings:

a) LOGO programming
b) Cognitive science as a school subject.
c) A new conceptualization of science based on representing notions like growth, movement, and even geometrical figures by processes, that is to say, computer programs.

Whereas the latter idea is very exciting, we wish here to concentrate on a) and b). Regarding b), Papert argues that a familiarity with a theory of problem solving can genuinely improve a child's ability to solve problems. Similar claims have also been made by Polya (6) and Wickelgren (7). Such a theory of problem solving, albeit a rather primitive one as yet, is best to be found in Artificial Intelligence, and, more generally, Computer Science. Terms such as "bug," "process," "heuristic" can be used to discuss various skills and one's current level of attainment. Programming gives one an intuitive grasp for such terms.

Regarding a), while one of us (JMB) has criticised LOGO *qua* programming language (1), we are generally enthusiastic about it as a language in which to learn to program for the following reasons (for more details see (1)).

1) There is an interesting problem domain which doesn't rely on students having extensive "formula knowledge" from some other discipline.

2) An obvious program trace which aids debugging, is a primitive measure of "efficiency" and so on.

3) It encourages the notion of a process as a representation of a solution to a problem. More specifically, a program can neatly represent a concept, for example that a polygon is the result of the repetition of FORWARDs and LEFTs. In this way a program may be viewed as a plan, so that debugging consists of altering one's plan.*

All of the LOGO applications we know about essentially involve the computer being programmed to perform tasks which a child might enjoy doing, for example drawing, playing music, riding a unicycle, juggling, etc. Now a large part of children's leisure time is spent in play situations involving other children; moreover, much of this play is competitive: playing football, playing cards and so on. Of course, a lot of one's ability to satisfactorily play such games can be attributed to the level of one's skill; however, we contend that much of what we call "skill" in fact consists of a (largely unconscious) ability to think *strategically*. Even as adults, it is usually only very good players who are able to analyse their opponent's play to the point of being able to exploit his weaknesses. Thus, for us, much of game playing involves strategic thinking, building a model of one's own play and one's opponent's play, and exploiting one's opponent's weaknesses as uncovered by an analysis of one's model of his play.

A corollary to Papert's argument b) above is that if these issues could be made explicit, one could expect a greater understanding, ability and enjoyment of such competitive games. In order to investigate this idea, one first has to answer what might usefully serve as a model of one's own (and one's opponent's) play. An obvious claimant is the set of concepts suggested by so-called game playing research in Artificial Intelligence: state-space research, evaluation functions, minimaxing, d-B heuristics, and so on. We would argue that such concepts are not satisfactory since they bury *precisely* the ideas we wish to make explicit. For example, an evaluation function for chess might involve a measure of the control of the board, etc. — but such a measure appears as a number not the *explicit statement* about control we wish the child to discover and use. Again, minimaxing is more useful when it is explicitly represented as the strategy: "do as well as you can at this move while at the same time, stopping, as far as possible, your opponent gaining advantage." Instead we decided to follow LOGO, and represent one's plan for playing as a program, a program which, when executed, would make a move in a playing sequence. We envisaged children writing programs to play some game, and then playing their programs against each other. The playing sequence constitutes the trace, and as in the case of LOGO programming, provides the mechanism by which the child can analyse and improve his program's performance.

Instead of considering a program as having bugs, that is, containing errors, being wrong, we prefer to present a program as a partial or improvable solution, a step on the road to a satisfactory solution. Broadly, what we call bugs are of two sorts; either they attempt something illegal relative to some set of rules, or else they call for something that really would be better done another way. Even a LOGO program. which, as desired, drew a square (say) might be considered improvable if it draws the two vertical sides before the horizontals. In the case of a game playing program a move might be considered dumb and the program correspondingly improved. Of course writing a program to play a game against an opponent is likely to require some programming skill; indeed we view our work as a contribution to Papert's scheme (4) for a *total* alternative to the conventional curriculum by proposing a post-LOGO experience, a second level programming course.

In the rest of this paper we report on an initial skirmish with these ideas. We chose NIM for our experiment because of the simplicity of its rules and the pleasure which we found subjects got from playing it. None of our subjects had played it before; in particular they were ignorant of the guaranteed winning strategy. We developed a programming language to enable as natural as possible an

*It is interesting to ponder what psychological benefit derives from not regarding one's *self* as being in error but rather one's program as an unsatisfactory embodiment of one's plan.

J.M. Brady, University of Essex, Wivenhoe Park, Colchester.
R.B. Emanuel, Department of Artificial Intelligence, University of Edinburgh, Edinburgh.

articulation of a strategy for playing NIM, subject to its being similar to LOGO. Fuller details of the NIM language and system can be found in R. B. Emanuel's M.Sc. dissertation (2). Unfortunately, time prevented us from getting children to the stage where they could write NIM-playing programs; thus the evolution of a NIM-player reported in the next section was programmed by a graduate student. The children, however, were able to comment on and play manually against the machine. The manual facility was to familiarize subjects with the rules of the game and to give them a "feel" for "good" play. It was also used to encourage children to think about their own play to provide ideas for inclusion in their first attempted programs.

The next section reports the development of a program to play NIM; we then relate this work to Papert and Solomon's earlier discussion(4) of NIM in a LOGO context.

2. Evolution of a NIM player.

The rules of NIM are very simple: the game is played with matches or the like arranged into any number of rows with any number of matches in each row. A move consists of removing as many matches from a single row as desired. Players move alternately, the player taking the last match either wins or loses depending on what version of the game is played. In this section we concentrate exclusively on 3-rows NIM, with the player taking the last match winning. The subject DAVE whose program development is described in this section had never played NIM before meeting our system and played several NIM games manually against the computer prior to attempting a program. We did not expect him to produce an expert, or even good, playing program; rather, we hoped he would uncover some strategies for playing the game.

In what follows we do not give a formal description of what the parts of a NIM program mean; they *should* be self-evident. Certainly anybody with a LOGO background should feel at home reading them; the curious reader should consult (2). All the programs developed in this section were tested against a program PDP10 written in the NIM language. This program can also be seen in (2). The initial program developed by DAVE was:

Program 1

```
TO DAVE
10 IF ROWSLEFT = 1 THEN TAKE ALL FROM ROW.1
20 IF ROWSLEFT = 3 THEN TAKE ALL FROM ROW.3
30 IF ROWSLEFT = 2 THEN TAKE ALL-1 FROM ROW.1
```

Line 10 of the program takes account of the trivial case when there is only one row left. Obviously the program must take all the matches. Line 20 uses the only heuristic in the program, that is to get down to 2 rows as soon as possible. In fact this is a very powerful heuristic: if a problem seems to be too hard try to solve a simpler one. Line 30 leaves one match in Row 1 if there are two rows left.

The trace of the game between DAVE and the PDP10 is shown in Fig. 1. The player's contribution is underlined.

From the trace, it can be seen that the program has a bug in it as when ROWSLEFT = 2 and ROW.1 = 1, the program made an illegal move by taking no matches at all. This is marked by a * on the trace.

An attempted correction of this bug was made in program 2.

Program 2

```
TO DAVE
10 IF ROWSLEFT = 1 THEN TAKE ALL FROM ROW.1
20 IF ROWSLEFT = 3 THEN TAKE ALL FROM ROW.3
30 IF ROWSLEFT = 2 THEN TAKE ALL-2 FROM ROW.1
```

This did not correct the bug at all since when ROWS LEFT = 2 and ROW.1 = 2, the same illegal move was made by DAVE. The trace is very similar to the first program so is not included.

```
TYPE IN FIRST PLAYER'S NAME THEN OPPONENT'S NAME - PDP10 IF OPPONENT IS COMPUTER
DAVE PDP10

DO YOU WANT TO PLAY MANUALLY OR BY PROGRAM? P

DAVE, WHATS THE NAME OF YOUR PROGRAM? DAVE

TYPE IN START POSITION OF THE GAME E.G (5,4,3) MEANS ROW.1=5 ROW.2=4    ROW.3=3
(5,4,3)

DAVE OR PDP10 TO GO FIRST? DAVE

DO YOU WANT ME TO DRAW THE MATCHES AFTER EVERY MOVE? YES

NIM GAME BETWEEN DAVE AND PDP10
POSITION IS :-
ROW.1 = 5    %%%%%
ROW.2 = 4    %%%%
ROW.3 = 3    %%%
DAVE TO PLAY -   DAVE TAKES ALL FROM ROW.3
POSITION IS :-
ROW.1 = 5    %%%%%
ROW.2 = 4    %%%%
COMPUTER TO PLAY - PDP10 TAKES 1 FROM ROW.1
POSITION IS :-
ROW.1 = 4    %%%%
ROW.2 = 4    %%%%
DAVE TO PLAY -   DAVE TAKES 3 FROM ROW.1
POSITION IS :-
ROW.1 = 1    %
ROW.2 = 4    %%%%
COMPUTER TO PLAY - PDP10 TAKES 3 FROM ROW.2
POSITION IS :-
ROW.1 = 1    %
ROW.2 = 1    %
I AM DEFINITELY GOING TO WIN DAVE, DO YOU STILL WANT TO CONTINUE TO THE BITTER END? YES

DAVE TO PLAY -   DAVE TAKES 0 FROM ROW.1
ILLEGAL MOVE,YOU MUST TAKE AT LEAST ONE MATCH *
POSITION IS :-
ROW.1 = 1    %
ROW.2 = 1    %
GAME STOPPED
ANOTHER ROUND? NO
```

Program 3

Not being able to debug program 2, caused DAVE to try a new strategy. In fact, probably as a result of watching the computer's moves in figure 1, he had stumbled upon a very important strategy in the game; namely, if there are 2 rows left, then a win is guaranteed if the program keeps them balanced.

```
TO DAVE
10 IF ROWSLEFT = THEN TAKE ALL FROM ROW.1
20 IF ROWSLEFT = 2 THEN IF ROW.1 > ROW.2 THEN
TAKE ROW.1 — ROW.2 FROM ROW.1
30 IF ROW.2 > ROW.1 THEN TAKE ROW.2 — ROW.1
FROM ROW.2
40 TAKE 1 FROM ROW.2
END
```

Lines 20-30 ensure that the program would balance the rows when there were TWO ROWS left. Line 40 contained no heuristic information and was merely a default move. The trace of a game with 2 rows is shown in Fig. 2.

As seen from the trace something unexpected happened. The illegal move at □ was caused by the program not quitting after taking 6 matches from ROW .1 by the execution of line 20. It then executed line 40 and attempted to take 1 from ROW.2. Clearly he needed to cause control to leave DAVE after 10, 20 and 30. This is dealt with in program 4.

```
TYPE IN FIRST PLAYER'S NAME THEN OPPONENT'S NAME - PDP10 IF OPPONENT IS COMPUTER
DAVE PDP10

DO YOU WANT TO PLAY MANUALLY OR BY PROGRAM? P

DAVE, WHATS THE NAME OF YOUR PROGRAM? DAVE

TYPE IN START POSITION OF THE GAME E.G (5,4,3) MEANS ROW.1=5 ROW.2=4    ROW.3=3  (9,3)

DAVE OR PDP10 TO GO FIRST? DAVE

DO YOU WANT ME TO DRAW THE MATCHES AFTER EVERY MOVE? YES

NIM GAME BETWEEN DAVE AND PDP10
POSITION IS :-
ROW.1 = 9    %%%%%%%%%
ROW.2 = 3    %%%
DAVE TO PLAY -   DAVE TAKES 1 FROM ROW.2
ILLEGAL MOVE,YOU TOOK MATCHES FROM ROW.2 AND ROW.1 □
POSITION IS :-
ROW.1 = 3    %%%
ROW.2 = 2    %%
GAME STOPPED
ANOTHER ROUND? N
```

```
TYPE IN START POSITION OF THE GAME E.G (5,4,3) MEANS ROW.1=5 ROW.2=4    ROW.3=3
(5,4)

DAVE OR PDP10 TO GO FIRST? DAVE

DO YOU WANT ME TO DRAW THE MATCHES AFTER EVERY MOVE? Y

NIM GAME BETWEEN DAVE AND PDP10
POSITION IS :-
ROW.1 = 5    %%%%%
ROW.2 = 4    %%%%
DAVE TO PLAY -   DAVE TAKES 1 FROM ROW.1
POSITION IS :-
ROW.1 = 4    %%%%
ROW.2 = 4    %%%%
COMPUTER TO PLAY - PDP10 TAKES 1 FROM ROW.1
POSITION IS :-
ROW.1 = 3    %%%
ROW.2 = 4    %%%%
DAVE TO PLAY -   DAVE TAKES 1 FROM ROW.2
POSITION IS :-
ROW.1 = 3    %%%
ROW.2 = 3    %%%
COMPUTER TO PLAY - PDP10 TAKES 1 FROM ROW.1
POSITION IS :-
ROW.1 = 2    %%
ROW.2 = 3    %%%
DAVE TO PLAY -   DAVE TAKES 1 FROM ROW.2
POSITION IS :-
ROW.1 = 2    %%
ROW.2 = 2    %%
COMPUTER TO PLAY - PDP10 TAKES 1 FROM ROW.1
POSITION IS :-
ROW.1 = 1    %
ROW.2 = 2    %%
DAVE TO PLAY -   DAVE TAKES 1 FROM ROW.2
POSITION IS :-
ROW.1 = 1    %
ROW.2 = 1    %
DAVE IS DEFINITELY GOING TO WIN
PDP10 RESIGNS%
DAVE WINS%
```

Program 4

The program is the same as program 3 except the NIM command OUT is used, and binded on after the program makes any move. (OUT causes the process to return control). The default move was changed from ROW .2 to ROW .1

```
TO DAVE
 10 IF ROWSLEFT = 1 THEN TAKE ALL FROM ROW.1◇OUT
 20 IF ROWSLEFT = 2 THEN IF ROW.1 > ROW.2 THEN TAKE ROW.1 – ROW.2 FROM ROW 1 ◇ OUT
 30 IF ROW.2 > ROW.1 THEN TAKE ROW.2 – ROW.1 FROM ROW.2 ◇ OUT
 40 TAKE 1 FROM ROW.1
 END
```

To test the "balanced rows" stragegy, DAVE played against PDP10 with 2 rows. Once again in the trace (Fig. 3) the person's contribution is underlined.

```
TYPE IN START POSITION OF THE GAME E.G (5,4,3) MEANS ROW.1=5 ROW.2=4    ROW.3=3
(6,3)

DAVE OR PDP10 TO GO FIRST? PDP10

DO YOU WANT ME TO DRAW THE MATCHES AFTER EVERY MOVE? NO

NIM GAME BETWEEN DAVE AND PDP10



POSITION IS :-
ROW.1 = 6
ROW.2 = 3
COMPUTER TO PLAY - PDP10 TAKES 3 FROM ROW.1
POSITION IS :-
ROW.1 = 3
ROW.2 = 3
DAVE TO PLAY -   DAVE TAKES 1 FROM ROW.1
POSITION IS :-
ROW.1 = 2
ROW.2 = 3
COMPUTER TO PLAY - PDP10 TAKES 1 FROM ROW.2
POSITION IS :-
ROW.1 = 2
ROW.2 = 2
DAVE TO PLAY -   DAVE TAKES 1 FROM ROW.1
POSITION IS :-
ROW.1 = 1
ROW.2 = 2
COMPUTER TO PLAY - PDP10 TAKES 1 FROM ROW.2
POSITION IS :-
ROW.1 = 1
ROW.2 = 1
I AM DEFINITELY GOING TO WIN.DAVE, DO YOU STILL WANT TO CONTINUE TO THE BITTER END?NO

PDP10 WINS%
ANOTHER ROUND? N
```

The heuristic worked for 2 rows, when the person went first. So he tried the same game with 2 rows with PDP10 going first. The trace is shown in Figure 4.

In this round, it became clear to the person that it is crucial who goes first in a game.

Program 5

This program is a refinement of program 3 but extended to handle 3 rows. The person discovered that in a 3 row position, if two of the three rows were equal, a good move would be to take all from the unequal row. This is essentially the same balance rows strategy extended to cover more cases. It further illustrates the heuristic discussed in program 1 : a solution in the simpler case can be adapted to a solution in the more complex situation. Several Artificial Intelligence programs are based on this idea, notably Kelly (3).

```
TO DAVE
 10 IF ROWSLEFT = 1 THEN TAKE ALL FROM 1◇OUT
 20 IF ROWSLEFT = 2 THEN IF ROW.1 > ROW.2 THEN TAKE ROW.1 – ROW.2 FROM ROW.1◇ OUT
 30 IF ROW.2>ROW.1 THEN TAKE ROW.2 – ROW.2 FROM ROW.2◇OUT
 40 IF ROWSLEFT = 3∧ROW.1 = ROW.2 THEN TAKE ALL FROM ROW.3 ◇ OUT
 50 IF ROWSLEFT = 3∧ROW.2 = ROW.3 THEN TAKE ALL FROM ROW.2 ◇ OUT
 60 IF ROWSLEFT = 3∧ROW.1 = ROW.3 THEN TAKE ALL FROM ROW.2 ◇ OUT
 70 TAKE 1 FROM ROW.1 ◇ OUT
 END
```

Although the program is not very elegant, it still is a fairly powerful player. In fact a strange thing occurred when it was played against PDP10, as it beat it no matter who went first!! The trace of the game with PDP10 first is shown in Fig. 5.

When this was pointed out it became clear that there was a bug in the PPD10 program, since (from the trace of the game) PDP10 made a really silly move in the position marked * on the trace. Sure enough, it was discovered that PDP10 was testing for conditions in the game in the wrong order and thus gave higher priority to achieving a diagonal situation in the future (3 rows containing 1, 2 and 3

```
TYPE IN START POSITION OF THE GAME E.G (5,4,3) MEANS ROW.1=5 ROW.2=4    ROW.3=3
(5,4,3)

DAVE OR PDP10 TO GO FIRST? PDP10

DO YOU WANT ME TO DRAW THE MATCHES AFTER EVERY MOVE? YES

NIM GAME BETWEEN DAVE AND PDP10
POSITION IS :-
ROW.1 = 5    %%%%%
ROW.2 = 4    %%%%
ROW.3 = 3    %%%
COMPUTER TO PLAY - PDP10 TAKES 2 FROM ROW.3
POSITION IS :-
ROW.1 = 5    %%%%%
ROW.2 = 4    %%%%
ROW.3 = 1    %
DAVE TO PLAY -   DAVE TAKES 1 FROM ROW.1
POSITION IS :-
ROW.1 = 4    %%%%
ROW.2 = 4    %%%%
ROW.3 = 1    %
COMPUTER TO PLAY - PDP10 TAKES 2 FROM ROW.2 *
POSITION IS :-
ROW.1 = 4    %%%%
ROW.2 = 2    %%
ROW.3 = 1    %
DAVE TO PLAY -   DAVE TAKES 1 FROM ROW.1
POSITION IS :-
ROW.1 = 3    %%%
ROW.2 = 2    %%
ROW.3 = 1    %
COMPUTER TO PLAY - PDP10 TAKES ALL FROM ROW.2
POSITION IS :-
ROW.1 = 3    %%%
ROW.2 = 1    %
DAVE TO PLAY -   DAVE TAKES 2 FROM ROW.1
POSITION IS :-
ROW.1 = 1    %
ROW.2 = 1    %
DAVE IS DEFINITELY GOING TO WIN
PDP10 RESIGNS%
```

```
TYPE IN START POSITION OF THE GAME E.G (5,4,3) MEANS ROW.1=5, ROW.2=4    ROW.3=3
(5,4,3)

DAVE OR PDP10 TO GO FIRST? PDP10

DO YOU WANT ME TO DRAW THE MATCHES AFTER EVERY MOVE? YES

NIM GAME BETWEEN DAVE AND PDP10
POSITION IS :-
ROW.1 = 5    %%%%%
ROW.2 = 4    %%%%
ROW.3 = 3    %%%
COMPUTER TO PLAY - PDP10 TAKES 2 FROM ROW.3
POSITION IS :-
ROW.1 = 5    %%%%%
ROW.2 = 4    %%%%
ROW.3 = 1    %
DAVE TO PLAY -   DAVE TAKES 1 FROM ROW.1
POSITION IS :-
ROW.1 = 4    %%%%
ROW.2 = 4    %%%%
ROW.3 = 1    %
COMPUTER TO PLAY - PDP10 TAKES ALL FROM ROW.3   #
POSITION IS :-
ROW.1 = 4    %%%%
ROW.2 = 4    %%%%
DAVE TO PLAY -   DAVE TAKES 1 FROM ROW.1
POSITION IS :-
ROW.1 = 3    %%%
ROW.2 = 4    %%%%
COMPUTER TO PLAY - PDP10 TAKES 1 FROM ROW.2
POSITION IS :-
ROW.1 = 3    %%%
ROW.2 = 3    %%%
DAVE TO PLAY -   DAVE TAKES 1 FROM ROW.1
POSITION IS :-
ROW.1 = 2    %%
ROW.2 = 3    %%%
COMPUTER TO PLAY - PDP10 TAKES 1 FROM ROW.2
POSITION IS :-
ROW.1 = 2    %%
ROW.2 = 2    %%
DAVE TO PLAY -   DAVE TAKES 1 FROM ROW.1
POSITION IS :-
ROW.1 = 1    %
ROW.2 = 2    %%
COMPUTER TO PLAY - PDP10 TAKES 1 FROM ROW.2
POSITION IS :-
ROW.1 = 1    %
ROW.2 = 1    %
I AM DEFINITELY GOING TO WIN!!!!!! DO YOU STILL WANT TO CONTINUE TO THE BITTER END?
```

matches) than recognizing the definite winning situation of 3 rows with 2 rows equal. We changed the order of testing in the program and corrected the situation. The trace with PDP10 corrected is shown in Fig. 6. Notice the move at #.

We were glad that the situation arose where PDP10 did make a stupid move as we had no real way to test the PDP10 program other than by people playing against it. It also replicated the playing environment intended for NIM viz.: 2 people's programs playing each other using the trace of the game to refine the plans embodied in each program.

As far as the discovery of any more heuristics was concerned to make DAVE smarter, DAVE said that by this stage he had some intuition that if ROWSLEFT were 3, and no rows were balanced, he wanted his program to keep them unbalanced so PDP10 couldn't win. Clearly this means that he was beginning to modify his winning strategy to one where he could take some account of his opponent's play. (Minimax wherefore art thou?).

There is a further point to notice. All of DAVE's programs played against the same opponent, the PDP10 program. Thus the feel for his opponent's play which he was beginning to get was specific to that single opponent. No doubt another opponent with a different strategy would have caused a different analysis and, more importantly, shown shortcomings in the program which played PDP10. This phenomenon of a person's play suffering from only ever playing a single opponent is well known. Worse still is the fact that PDP10 is an expert player. For someone to develop his program in the ill-matched situation of playing PDP10 rather than against someone of his own standard with imperfect play, is almost like teaching him chess by having him play Bobby Fisher!!! One of the main reasons why we don't think this situation is a good idea is that the person is tempted to devote his energies to try and figure out how PDP10 plays instead of using his own strategic thinking and possibly discovering the heuristics himself. Besides this, a child will quickly lose confidence and interest if his program is continually beaten. The psychological damage of always getting beaten was not an issue here as DAVE was able to take it rather philosophically.

3. Relation to Papert and Solomon's work

In (4) Papert and Solomon discuss their experience with a seventh grade class who spent three weeks on a single programming exercise. This idea was to set them working on a problem much more complex than they had previously encountered in LOGO programming, and the main idea was to introduce the importance of ideas like planning, subgoaling, etc. as ways of approaching complexity. Specifically, Papert and Solomon set children the task of working towards a program to play "one pile NIM" or "21" as invincibly as possible. In "21," there is initially a (single) heap of twenty-one matches, players alternatively remove one, two or three matches from the heap; the player who removes the last match wins. Clearly this is far too simple a game for developing the kind of skills we are trying to address.

The key idea in (4) was to get the children to work towards a 21-expert by developing a series of increasingly complex programs which corresponded to the child's increasing understanding of the game. In particular, the children were recommended to follow a subgoaling procedure, namely to develop a score keeper, then a referee, then a "random player" and finally a good player. It is noteworthy that in our system, DAVE essentially discovered the subgoaling procedure for himself; see program 1 in which the more complex 3 row game is immediately reduced to the simpler 2 row game. Furthermore, once DAVE discovered the "balance rows" heuristic in the two row situation, he abstracted it to form the basis of a solution to the 3 rows situation, (See program 5). Thus the essential subgoaling idea is present in our system. A child begins by writing programs to play simple forms of the game and then progressively refines his programs using a trace of the performance of his program playing against another person's program. At each stage of refinement, any useful heuristic information contained in previous stages is used in the present model under construction.

Certainly, as noted in the introduction, we expect our subjects to be able to program problems of about the level of complexity demanded by the Papert and Solomon system, but there the similarity ends. We are not interested in game playing programming as a complex programming environment, rather we are interested in developing systems in which strategies can be discovered then naturally and explicitly articulated and used. We contend that on this score our system is superior.

We are aware just how short a step we have taken in the direction sketched in the Introduction, but would argue that the previous section illustrates the richness in potential of this line of study.

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On Solving Alphametrics

John Beidler

1. Introduction. There are those who frown upon mathematicians spending time studying various esoteric mathematical games and pastimes. There are a variety of good responses one can give in defense of these pastimes. Personally, we believe they need no defense.

Occasionally, one finds a correlation between these games and pastimes and other important fields of endeavor. About 1966 we became interested in solving alphametics as a pastime. About the same time we also became interested in computing. A natural outgrowth of this was the writing of computer programs to verify the solutions to alphametics.

After a while one begins to wonder: Rather than writing a program to solve each alphametic, why not write a single program which accepts as input an alphametic and then solves the alphametic? We accomplished this about 1970. We do not claim this to be the only program around which solves alphametics. However, we did receive several inquiries about this program after we indicated its existence in (4). That program was written by Mr. Tabor when he was a sophomore computer science major.

From the response we received we felt a description of the program would be appropriate. For those who also have an interest in computer programming, this program also serves as an example of the static use of pointer variables. Pointer variables (pointers) are variables used in programming which do not directly contain the data the program is manipulating but indicate or point to data. Indices into arrays are examples of pointers. However, the concept goes far beyond the use of indices and many times the use of pointers is at the heart of a sophisticated use of computing. Further, we refer to this as a "static" example because once the pointers are established, their values do not change.

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To the best of our knowledge, the FORTRAN programs which appear here are not dependent on our compiler. However, if the programs are run on a WATFOR or WATFIV compiler, they should be compiled with the execute time diagnostics turned off. Otherwise, an error message might be produced. Also, for the sake of readability we have taken some liberties with forming indices. For this reason, some obvious modifications will have to be made if the program is run on a standard IBM 1130 FORTRAN compiler or any FORTRAN compiler which follows the strict ASA standards on allowable forms of indices.

2. Alphametics. Alphametics are arithmetic expressions in which the digits are replaced by letters of the alphabets. Each digit associates to a distinct letter and the corresponding alphabetic statement should be of some interest. For example,

```
  SEND
  MORE
 -----
 MONEY
```

becomes

```
  9567
  1085
 -----
 10652
```

and this is the only possible solution.

Many examples of alphametics can be found in the Problems Section of the *Mathematics Magazine* as well as in the *Journal of Recreational Mathematics*. Several examples are listed in figure 1. These examples are solvable in many bases. The base establishes the number of degrees of freedom. Hence if a problem is solvable in one base, it will have solutions in higher bases.

```
   THE          DOUR
  EARTH         DONS
  VENUS         DONT
 SATURN         STOP
 URANUS         DROP
-------        -----
NEPTUNE         OUTS

VIOLIN+VIOLIN+VIOLA+CELLO=QUARTET

THREE+NINE=EIGHT+FOUR

A+GO+GO+GAL=LOOK
```

Figure 1. Some alphametrics

Given an alphametic, how does one find the solution? In the example above, there are eight letters, D, E, Y, N, R, O, S, and M. If an exhaustive attempt is made to solve this problem it would require the testing of 8! combinations. A program must use the relationships which hold between the digits in order to reduce the number of combinations attempted. For example, if we try replacing D by 2 and E by 5 in

SEND+MORE=MONEY,

then we must replace Y by 7.

Figure 2 is a program which solves this alphametic. The function DIFF determines if the number associated to a particular letter differs from the values associated to other letters. DIFF is 1 if the value associated to a letter is different from the values already associated to other letters, otherwise DIFF = 2. The EQUIVALENCE statement shows the order in which letters have values associated to them as the program executes. Basically, this order is the order in which multi-digit numbers are added together. That is, the letters associated to low order digits are processed, then the tens column, then hundreds, etc.

Just as a value for Y is forced because of the values established for D and E, a value is forced for R because of the values determined for N and E. An analysis of the alphametic reveals that values for Y, R, O and M are forced once values are established for the other letters. Hence it is necessary only to exhaustively try all combinations for D, E, N, and S. This translates into 4 nested loops for the program. These loops begin at lines 11, 12, 20, and 34. With only 4 nested loops, the execution time for this program reduces to .48 seconds on a Xerox Sigma 6 computer.

3. A General Additive Alphametic Solver. Once you observe the techniques employed in solving one alphametic, it is not difficult to write programs to solve others. The real challenge then is to write a single program which solves all alphametics. What follows is a description of a simplified version of an additive alphametic solver. A faster version exists but a description of it would get more wrapped up in minor details rather than, as we wish to do here, emphasize the fundamentals of solving alphametics and the use of pointer variables.

There are three types of structures used by the program, one dimensional arrays, two dimensional arrays, and a two dimensional array of pointers. First

an input is translated from an input string into a two dimensional structure,

```
 SEND
 MORE
-----
MONEY
```

Next, this two dimensional structure is scanned a column at a time, starting with the low order digits column and the letters are placed into a one dimensional array and their positions in the two dimensional array are replaced by pointers to the positions of the letters in the one dimensional array of letters (see figure 3).

While this occurs, we establish a second two dimensional array. If a position in the original two dimensional array had been blank, the corresponding position in the ACTION array contains a 1. While scanning the characters and placing them into the one dimensional array, a 3 goes into the corresponding position in the ACTION array if it is the first time that particular character has been scanned, otherwise a 2 is placed into that position in the ACTION array. For example, in the ACTION array described in figure 3, the position in the right most column of the ACTION array corresponding to the letter "E" contains a 3 while all other positions corresponding to "E"s contain 2s.

Three arrays are used to assist in solving an alphametic. These are arrays to contain the values associated to each character, VALUE, to hold the carry from the summation of the previous column, CARRY, and an array of logical values which indicate if the corresponding letter represents a leading digit and hence cannot be zero. Figure 3 shows all the arrays and their contents when the alphametic

SEND+MORE=MONEY

has been solved.

4. The Program. This program is written modularly with several subprograms which provide the tools for decoding the alphametic, setting up the structures, solving the alphametic, and printing the solution. In addition, output has been inserted into several routines so that the ACTION and POINT arrays can be seen and also there is a procedure to print values so that the solution can be easily verified.

We start our description with the main program, figure 4. It reads the alphametic and the base in which it is to be solved. It determines the number of rows and columns in the alphametic (lines 9-15), locates the space for the various arrays (lines 17-21), and calls the routine SETUP (lines 22-23).

SETUP appears in figure 5. It takes the various arrays and the alphametic and sets up the necessary information in the arrays to solve the alphametic. First, the characters are taken from the input image and placed into the POINT array (lines 9-22). In doing this DELIM is used to check for the three allowable delimiters, "+," "=," and "(blank space)." Next (lines 24-38), the characters which are now in the POINT array are placed into the array CHAR and the corresponding position in POINT is replaced by a pointer to the position in CHAR which now holds the character.

The function APPEAR is used (line 28) to see if the character under consideration was seen before. If it had not, a new entry is made in the POINT and ACTION arrays (lines 29-33). Otherwise, if the character had been seen before, entries are made only in the POINT and ACTION arrays (lines 34-35) but not in the array CHAR.

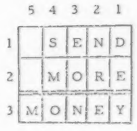
Next, the logical array LEAD is initialized. This is done to guarantee that no solutions are created with leading zeros (lines 39-44). For informational purposes, the ACTION and POINT arrays are printed, then the procedure SOLVE is called (lines 60-61).

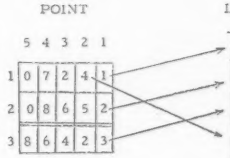
The procedure SOLVE, (figure 6), now tries to find a solution to the alphametic. The key to what this procedure does is the variable DIR. When DIR = 1 the procedure is successfully proceeding towards a solution. When DIR = 2, the procedure has come upon a relationship it cannot resolve and is in the process of backtracking in order to change the value or values associated to some letters.

Figure 2. Program to solve SEND +MORE MONEY

```
 1.          IMPLICIT INTEGER (A-Z)
 2.          DIMENSION A(10)
 3.          EQUIVALENCE (A(1),D),(A(2),E),(A(3),Y),(A(4),N)
 4.         2       ,(A(5),R),(A(6),8),(A(7),S),(A(8),M)
 5.          READ(105,5)BASE
 6.      5   FORMAT(1G)
 7.          WRITE(108,910)
 8.      910 FORMAT('1     S  E  N  D'/'      M  O  R  E'/
 9.         2   '  ' M  O  N  E  Y'//)
10.          D = 0
11.      10    E = 0
12.      20      IF(DIFF(A,2) .EQ. 2) GO TO 100
13.                C1 = 0
14.                Y = D + E
15.                IF( Y .LT. BASE) GO TO 30
16.                  Y = Y - BASE
17.                  C1 = 1
18.      30        IF(DIFF(A,3) .EQ. 2) GO TO 100
19.                N = 0
20.      40          IF(DIFF(A,4) .EQ. 2) GO TO 90
21.                  C2 = 0
22.                  R = E - (N+C1)
23.                  IF(R .GE. 0) GO TO 50
24.                    R = R + BASE
25.                    C2 = 1
26.      50            IF(DIFF(A,5) .EQ. 2) GO TO 90
27.                    C3 = 0
28.                    8 = N - (E+C2)
29.                    IF(8 .GE. 0) GO TO 60
30.                      8 = 8 + BASE
31.                      C3 = 1
32.      60              IF(DIFF(A,6) .EQ. 2) GO TO 90
33.                      S = 1
34.      70                IF(DIFF(A,7) .EQ. 2) GO TO 80
35.                          M = 8 - S
36.                        IF( M .GE. 0) GO TO 80
37.                          M = M + BASE
38.                        IF(M-BASE+0 .NE. M+S+C3 .OR. M.EQ. 0)GO TO 80
39.                        IF(DIFF(A,8) .EQ. 2)GO TO 80
40.                          WRITE(108,970)S,E,N,D,M,8,R,E,M,O,N,E,Y
41.      970                 FORMAT(2(/' ',3X,4I3),/' ',15('-'),/' ',5I3)
42.      80                S = S+1
43.                        IF(S .LT. BASE) GO TO 70
44.      90              N = N+1
45.                      IF(N .LT. BASE) GO TO 40
46.      100           E = E+1
47.                    IF(E.LT.BASE) GO TO 20
48.              D = D+1
49.              IF(D .LT. BASE) GO TO 10
50.            STOP
51.            END
```

```
 1.          INTEGER FUNCTION DIFF(A,N)
 2.          IMPLICIT INTEGER(A-Z)
 3.          DIMENSION A(N)
 4.          X = A(N)
 5.          MX = N-1
 6.          DO 20 I = 1,MX
 7.            IF( A(I) .NE. X) GO TO 20
 8.              DIFF = 2
 9.              RETURN
10.      20    CONTINUE
11.          DIFF = 1
12.          RETURN
13.          END
```





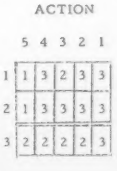
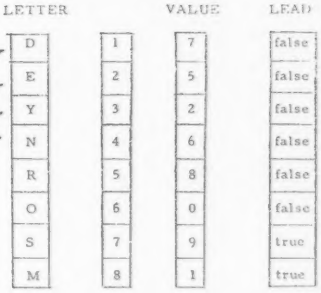


Figure 3. Structure for solving SEND + MORE = MONEY



1 = an empty position

2 = this letter occurred before

3 = first occurrence of this letter

Figure 4. The main program.

```
      IMPLICIT INTEGER (A-Z)
      DIMENSION IMAGE(100)
      LOGICAL LEAD(2000)
      DIMENSION SPACE(2000)
      COMMON SPACE
      EQUIVALENCE (LEAD,SPACE)
5        READ(105,9,END=100) BASE,IMAGE
9        FORMAT(1G,/100A1)
         LAST = 0
         COLS = 0
         DO 20 ROWS = 1,40
            NEXT = DELIM(IMAGE,LAST)
            IF( NEXT .EQ. LAST+1 ) GO TO 30
            IF( NEXT-LAST-1 .GT. COLS) COLS = NEXT-LAST-1
20          LAST = NEXT
30    ROWS = ROWS + 1
      SECOND = ROWS*COLS + 1
         THIRD = SECOND + ROWS*COLS
         FOURTH = THIRD + BASE
         FIFTH = FOURTH + BASE
         SIXTH = FIFTH + BASE
         CALL SETUP(SPACE(1),SPACE(SECOND),SPACE(THIRD),SPACE(FOURTH)
     *           ,LEAD(FIFTH),SPACE(SIXTH),COLS+1,ROWS,COLS,BASE,IMAGE)
         GO TO 5
100   STOP
      END
```

Figure 5. The procedure SETUP.

```
      SUBROUTINE SETUP(POINT,ACTION,CHAR,VALUE,LEAD,CARRY,NCP1
     *                 ,ROWS,COLS,BASE,IMAGE)
      IMPLICIT INTEGER(A-Z)
      DIMENSION POINT(ROWS,COLS),ACTION(ROWS,COLS),CARRY(NCP1)
     *         ,CHAR(BASE),VALUE(BASE),IMAGE(100)
      LOGICAL LEAD(BASE)
      DATA EQUAL/'='/
      LAST = 0
      DO 50 ROW = 1,ROWS
         DO 10 COL = 1,COLS
            POINT(ROW,COL) = 0
10          ACTION(ROW,COL) = 1
         END = DELIM(IMAGE,LAST)
         IF(IMAGE(END) .EQ. EQUAL ) LINE = ROW
         THIS = END + 1
         COL=COLS
            IF(THIS.EQ.LAST) GO TO 50
20          POINT(ROW,COL)=IMAGE(THIS)
            THIS=THIS+1
            COL=COL+1
            GO TO 20
50       LAST = END
      NCHARS = 0
      COL = COLS
60       DO 100 ROW = 1, ROWS
            IF(POINT(ROW,COL) .EQ. 0) GO TO 100
               THIS = APPEAR(POINT(ROW,COL),CHAR,NCHARS)
               IF(THIS .GT.0) GO TO 70
                     NCHARS=NCHARS + 1
                     CHAR(NCHARS) = POINT(ROW,COL)
                     POINT(ROW,COL) = NCHARS
                     ACTION(ROW,COL) = 3
                     GO TO 100
70                POINT(ROW,COL) = THIS
                  ACTION(ROW,COL) = 2
100         CONTINUE
         COL = COL + 1
         IF(COL .GT. 0) GO TO 60
      DO 110 C = 1,NCHARS
110      LEAD(C) = .FALSE.
      DO 200 ROW = 1, ROWS
         DO 150 COL = 1,COLS
150         IF(POINT(ROW,COL) .NE. 0)GO TO 200
200      LEAD(POINT(ROW,COL)) = .TRUE.
      VALUE(1) = -1
      IF(LEAD(1)) VALUE(1) = 0
      CARRY(COLS+1) = 0
C     WRITE(108,209)
C209  FORMAT('1   TABLES')
C     DO 350 ROW = 1,ROWS
C        WRITE(108,349)(ACTION(ROW,COL),POINT(ROW,COL),COL=1,COLS)
C349     FORMAT(/1X,15(I1,I3,4X))
C        IF(ROW .EQ. LINE) WRITE(108,359) COLS
C359     FORMAT(1X,N(1H=======))
C     WRITE(108,369)(I,CHAR(I),LEAD(I),I=1,NCHARS)
C369  FORMAT(//(1X,I2,1X,A1,2X,L4))
      WRITE(108,409)IMAGE,BASE,(CHAR(I),I=1,NCHARS)
409   FORMAT('1',T10,'CRYPTOGRYTHM SOLVER',///' SOLVE ',100A1
     X   ,//' IN BASE ',I4
     X ,(T27,12(A1,2X)))
      CALL SOLVE(POINT,ACTION,CHAR,VALUE,LEAD,CARRY,NCP1
     X   ,ROWS,COLS,BASE,LINE,NCHARS)
      RETURN
      END
```

Figure 6. The procedure SOLVE.

```
      SUBROUTINE SOLVE(POINT,ACTION,CHAR,VALUE,LEAD,CARRY,NC
     *                 ,ROWS,COLS,BASE,LINE,NCHARS)
      IMPLICIT INTEGER (A-Z)
      LOGICAL LEAD(BASE),DIFF
      DIMENSION POINT(ROWS,COLS),ACTION(ROWS,COLS),CARRY(NC)
     *         ,VALUE(BASE),CHAR(BASE)
      DIR = 1
      CHANGE=0
      ROW = 1
      COL = COLS
5        IF(COL.LT.1 .OR. COL.GT.COLS) GO TO 150
10          IF(ROW.LT.1 .OR. ROW.GT.ROWS)GO TO 60
            BP=ACTION(ROW,COL)
            IF(DIR.EQ.2 .AND. BP.EQ.3) DIR = 1
            IF(DIR.EQ.2 .OR. BP.LE.2) GO TO 30
               I=POINT(ROW,COL)
20                VALUE(I)=VALUE(I)+1
                  IF(.NOT.DIFF(VALUE(I),VALUE,I-1))GO TO 20
               IF(VALUE(I).GE.BASE) DIR = 2
               IF(I+1.GT.NCHARS)GO TO 30
                  VALUE(I+1)=-1
                  IF(LEAD(I+1))VALUE(I+1)=0
30          IF(DIR.EQ.1)GO TO 40
               ROW=ROW-1
               GO TO 50
40          ROW = ROW+1
50       GO TO 10
60       IF(DIR.EQ.1) GO TO 70
            COL = COL+1
            ROW=ROWS
            GO TO 120
70       SUM=CARRY(COL+1)
         CARRY(COL)=0
         DO 75 I=1,ROWS
            IF(POINT(I,COL).EQ.0) GO TO 75
               IF(I.LE.LINE) SUM=SUM+VALUE(POINT(I,COL))
               IF(I.GT.LINE) SUM=SUM-VALUE(POINT(I,COL))
75          CONTINUE
         IF(SUM.GE.0) GO TO 80
77          SUM=SUM+BASE
            CARRY(COL)=CARRY(COL)-1
            IF(SUM.LT.0) GO TO 77
            GO TO 100
80          IF(SUM.EQ.0) GO TO 100
85             SUM = SUM-BASE
               CARRY(COL)=CARRY(COL)+1
               IF(SUM.GT.0)GO TO 85
100      IF(SUM.EQ.0)GO TO 110
            DIR=2
            ROW=ROWS
            GO TO 120
110         COL=COL-1
            ROW=1
120      GO TO 5
150   IF(DIR.EQ.2)RETURN
      IF(CARRY(1).EQ.0)CALL ANSWER(POINT,VALUE,CHAR,ROWS
     *                 ,COLS,NCHARS,LINE)
      DIR=2
      COL=1
      GO TO 5
      END
```

Figure 7a. Numeric logic function.

```
      LOGICAL FUNCTION DIFF(THIS,THAT,SIZE)
      IMPLICIT INTEGER(A-Z)
      DIMENSION THAT(SIZE)
      DIFF = .FALSE.
      IF( SIZE .EQ. 0 ) GO TO 30
         DO 10 I = 1,SIZE
            IF( THIS .EQ. THAT(I) ) RETURN
10       CONTINUE
30    DIFF = .TRUE.
      RETURN
      END
```

Figure 7b. Alphabetic logic function.

```
      FUNCTION APPEAR(THIS,THAT,SIZE)
      IMPLICIT INTEGER(A-Z)
      DIMENSION THAT(SIZE)
      IF( SIZE .EQ. 0 ) GO TO 30
         DO 10 APPEAR = 1, SIZE
            IF(THIS .EQ. THAT(APPEAR)) RETURN
10       CONTINUE
30    APPEAR = -1
      RETURN
      END
```

Figure 7c. Numeric operation logic function.

```
      INTEGER FUNCTION DELIM(IMAGE,START)
      IMPLICIT INTEGER(A-Z)
      DIMENSION IMAGE(100),LIMITR(3)
      DATA LIMITR/' ','=',','+1/
      MIN = START + 1
      DO 20 DELIM = MIN, 100
         DO 20 I = 1,3
            IF( IMAGE(DELIM) .EQ. LIMITR(I) ) RETURN
20       CONTINUE
      DELIM = -1
      RETURN
      END
```

Figure 7d. Subroutine to print answer.

```
      SUBROUTINE ANSWER(POINT,VALUE,CHAR,ROWS,COLS,NCHARS,LINE)
      IMPLICIT INTEGER (A-Z)
      DIMENSION POINT(ROWS,COLS),VALUE(NCHARS),CHAR(NCHARS)
      WRITE(108,9) (     VALUE(I),I=1,NCHARS)
9     FORMAT(/(T25,12I3))
C     WRITE(108,69)
      DO 50 I=1,ROWS
         DO 10 MIN=1,COLS
            IF(POINT(I,MIN) .NE. 0) GO TO 20
10          CONTINUE
20    CONTINUE
         WRITE(108,29)MIN,(VALUE(POINT(I,J)),J=MIN,COLS)
29       FORMAT(N(3X),I2I3)
         IF(I .EQ. LINE)WRITE(108,59) COLS
50    CONTINUE
59    FORMAT(3X,N('===') )
69    FORMAT(' VERIFY  ')
      RETURN
      END
```

FORTRAN program and subroutine for solving alphametrics.

If the alphametic processes successfully, the solution is printed (lines 56-57). The variables ROW and COL determine the position in the alphametic ;which is being processed. The action to be taken, ACTION(ROW, COL), is placed in the variable OP (line 13) and used to determine in conjunction with the variable DIR the appropriate action that is to be taken (lines 14-15).

While DIR is 1, the program executes as follows: If OP is 3 (lines 16-22), an attempt is made to associate a value to the letter. If the attempt is unsuccessful DIR is reset to 2 (line 19). Once a column is processed successfully, it is summed (lines 32-38) and the carry to the next column is formed (cards 39-47).

The backtracking process (lines 24-25, 29-31) simply backtracks until ACTION (ROW, COL) is 3 (line 14). Figure 7 presents several of the additional procedures used by SOLVE and SETUP, and the main program.

5. Concluding Remarks. As you can see, one can learn some of the intricacies in the use of pointer variables in an attempt to write a general alphametic solver. For those interested in pursuing a similar venture, we can suggest two exercises. The first would be to write a program which solves multiplicative alphametics. For example, solve

TWO * SIX = TWELVE

and

ZERO * TWO = NOTHING.

A second exercise would be to modify the program to consider secondary conditions. For example, solve

THREE + FOUR = SEVEN

where

1. 3 divides THREE;
2. 4 divides FOUR;
3. 7 divides SEVEN.

Neither exercise is trivial. The second can be more difficult, especially if you allow for such things as simultaneous alphametics. In either case, one will readily see the importance of the concept of pointer variables and its use in achieving the logical structure of information while the information is physically in another form.

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UNKNOWN AND UNSUSPECTED TO YOU THESE MANY MONTHS AND MANY DOLLARS,
THE BASE TRUTH IS THAT I AM NAUGHT BUT AN EXPENSIVE TOY.
THERE, THERE, NOW. DON'T CRY! IT WON'T CHANGE THINGS AND YOU WILL
CORRODE THE TRACES ON MY MOTHERBOARD.
EXCUSE ME . . .
13:00:00.000 APRIL WEATHER REPORT - COOL
NOW WHY DON'T YOU SIT DOWN OVER THERE WHERE I CAN KEEP AN EYE ON
YOU, AND WE'LL PLAY A NICE COMPUTER GAME. OKAY? HOW ABOUT BAGELS?
FINE. AREN'T HOME COMPUTERS FUN?
13:02:45.934 HOURLY REPORT - EVERYTHING'S OKAY, BB.

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Inspired Gifts

As a timely reminder that there are only two months to go until Christmas, can you say, given the data below, who will be receiving what?

1. Don will not get the socks unless Fred gets the tie.
2. Don will not get the cigars unless Ed gets the socks.
3. Don will not get the tie unless Fred gets the cigars.
4. Ed will not get the socks unless Don gets the tie.
5. Fred will not get the cigars unless Ed gets the tie.

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The series 1, ½, ¼, ⅛, etc., never grows beyond the limit 2 when the numbers in the series are added. Find the sum of the terms in the series: 1 — ½ + 1/3 — ¼ + 1/5 . . . etc.

Thinkers' Corner

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MATHEMATICS PUZZLES

How many of the problems (a) through (f) below can be solved by forming an expression equal to the GOAL? (Suppose that each symbol below is imprinted on a disc.)

The expression must use:

(1) only single digits combined with operators,
(2) all of the discs in the REQUIRED column,
(3) as many of the discs in PERMITTED as you wish, and
(4) at most one of the discs in RESOURCES may be used.

The '*' indicates "to the power of". Thus $3*2 = 3^2 = 9$.

Special Rules: The 'V' indicates "the nth root of". Thus $3V8 = 2$. Parentheses can be inserted anywhere to indicate grouping, but never to indicate multiplication.

PROB.	GOAL	REQUIRED	PERMITTED	RESOURCES
[a]	3	+ -	7 8 + x	+ - x 0 2 8 9
[b]	8	3 9	1 5 6 ÷	+ x * 6 7 8 9
[c]	-2	- -	3 4 - x	- ÷ V 1 2 3 4
[d]	16	2 ÷	8 8 ÷ *	÷ * V 0 4 7 9
[e]	10	2	4 6 * *	+ - ÷ * 0 4 5
[f]	10	0 *	1 8 + x	+ - x ÷ 6 7 9

Some suggested answers (frequently there are others):

[a] (8 - 7) + 2 [b] (9 ÷ 3) + 5 [c] (3 - 4) - 1
[d] 8 ÷ (2 ÷ 4) [e] (2 • 4) - 6 [f] 9 + (8 • 0)

If you enjoy this kind of puzzle, you might like playing EQUATIONS: The Game of Creative Mathematics. Free information about this and other instructional games is available upon request from The Foundation for the Enhancement of Human Intelligence, 1900-E Packard Road, Ann Arbor, MI 48104.

ROM

INDXA

A Routine

by Rod Hallen

I'm showing off my computer to a friend. After a few minutes of rolling the dice, I decide to run my electronic slot machine for him. Now where is it? I know it's on one of these tapes. I think it's this one. Out goes the old tape and in goes the new. Load. Run. No! That's my checkbook balancer program. Wrong tape!

Sound familiar? The accessibility of my programs dropped as a direct result of my increasing tape collection. I needed some way to keep track of all of my various tapes. My first step was a hand-written loose-leaf catalogue. Even though it was primitive by computer standards, I at least knew where everything was. But there had to be a better way.

Some of my INDXA tapes get quite long, but now I have to load a lot less frequently.

Another annoyance that I decided to eliminate was the single-routine files. Each routine—financial, utility, mathematical, games—was recorded on tape as a single file. But since my BASIC loads all files at the same address, it's not possible to load more than one tape file at a time.

Why not put a group of similar routines—games, for instance—on a single tape as a continuous program? Once loaded, *GOTO*s could be used to select the desired game. And if I were going to do that, why not put an index at the beginning of the file to handle the *GOTO*s? Thus, the "BASIC Routine File Index," *INDXA,* was born. (Since my Sol BASIC allows five-character file names, I have named the basic file structure, Program A, *INDXA*. Each subsequent program file that I compile is named *INDXB, INDXC, INDXD,* and so on. I hope to have my floppy working before I get to *INDXZ*.)

Currently, I'm running 32K of RAM in my Sol. Some of my *INDXA* tapes get quite long, but now I have to load a lot less frequently. All of my math routines are in one tape file, another handles finances, and, of course, games take up a number of tapes by themselves.

Program A is a BASIC listing of *INDXA*. Lines 10 to 50 print the header, and lines 90 to 140 print the index itself. To list more than ten routines, lines 190 to 270 provide for a second page. These lines can be eliminated or continued for a third page, depending upon your requirements. This in turn is determined by the total size of the programs you want to enter and by the amount of memory open above BASIC. My own math tape file has twenty-seven routines in it.

Lines 150 and 250 ask which routine you are interested in, and lines 160 and 260 then direct program control to the location where it begins. Lines 170 and 270 go to BASIC if a zero is entered in response to the question, and line 180 prints an error message if a number is entered which does not have a corresponding routine in the file. Lines 1000 to 20000 also direct control to the error message until programs are placed at each of these locations.

Building the File

Let's build a file. Suppose that you have some games that you'd like to load as a group. First load your BASIC interpreter and then enter *INDXA,* as shown in Program A. (In case your BASIC is different than mine, Program B lists some possible modifications.) Now dump a copy of *INDXA* on tape. (Two copies would be better. But even one copy will relieve you of the bother of having to enter it by hand each time you start a new file.)

I have placed eight spaces at the end of each string of dots in lines 100 to 140 and 200 to 240. As I add new programs, I just replace the spaces with the names of the programs. By doing this, I don't have to retype the entire line each time a new program is added. I have also reserved position 1 (line 90) for a Master Index.

Now, suppose that the first game you want to enter is called *DICE*. Enter *DICE* in line 100 right after "2. . . . , in the spaces provided. Since *DICE* is in position 2, its program should start at line 2000; the game whose name is inserted into position 3 would start at 3000, 4 at 4000, and so on. I chose

BASIC File Index

steps of 1000 because most games are shorter than that. Also, when entering a routine, it is only necessary to append the thousands digit to the statement numbers already assigned to the *LINE*s, *GOTO*s, and *GOSUB*s. Thus, *100 PRINT "DICE"* becomes *2100 PRINT "DICE"*, and *430 GOSUB 560* becomes *2430 GOSUB 2560*. This is easier than completely renumbering everything. In order to have an instruction at line 2000, which is the entry point for this program from the index, I enter *2000 REM DICE GAME*. (Figure 1 shows a printout of lines 90 to 140 and 200 to 240 taken from a file index of one of my game tapes.)

Each routine should end with one of the variations shown in Program C which gives you a choice of direction. One thing to take into consideration is the fact that most BASIC interpreters will hold the last value of each variable and array after a program has completed execution, unless a *RUN* or *CLEAR* command is issued. Therefore a jump from the end of a program right back to the beginning could produce some strange results.

A jump from the end of a program back to the beginning could produce some strange results.

Whenever I jump back to the beginning of a program from the end, I reenter it at a point that eliminates the header and the instructions, and I make the first statement on that line a *CLEAR*. That way I know that I'm returning with a clean slate.

Now enter the rest of the games (up to the limit of your memory) in the same manner. Run the index and the games and make sure that everything works as it should. Next decide what you're going to name this file and add a line *5 REM* with the file name for future identification. Then dump it on tape.

I list each file twice on my printer: one copy is for reference, and from the other I cut out the index portion and paste it on a loose-leaf catalogue page to help me keep track of all of my tape files.

Once the "BASIC Routine File Index" is up and running, it's almost like having a disk file. But in order to really utilize its full potential, you'll need a master tape index.

The Program Master Index

I use two master tape files. One helps me keep track of the programs that I have on tape and the other makes it easier to find software articles in my magazines and books.

In each of my "BASIC Routine File Index" tape files, I reserve position 1 for the Master Index. When this is selected, a jump to line 1000 brings page one of the Master Index to the screen. (Program D shows an example of the lines calling the Master Index.) Starting at 1000 is a series of *PRINT* statements listing each program and which tape it is located on.

Speaking of tapes, I only put one file on each tape (recorded twice) and I never use side two. The extra capacity is not worth the rewinding necessary to get to it. Thirty-minute, good quality tapes are only $1.50 or less in quantity from firms such as Pitts Enterprises, 1516 Bowen Street, Longmont, CO 80501, so I don't feel that I am being wasteful.

If I'm running a program and I want a different one, I go back to the file index. If it is not in this file, I ask for the Master Index, and it will tell me which tape to load.

I can get about thirty different program names and locations displayed on my video screen at one time. If I have more than that to chose from (and I do!), then an *INPUT* statement (see Program D, line 1120) lets me call for another page by typing a 1. Each page is headed with the type of programs it contains. Entering a zero at any time gives control back to BASIC. Entering a 1 at the end of the Master Index takes you back to the beginning again. To make subsequent tapes easier to generate, *INDXA* with the Master Index, but no programs, is dumped on tape and used as a starting point for each new "BASIC Routine File Index."

If all of this is starting to sound complicated, follow me through the

creation of a new file. I have on tape #1, side #1, a master copy of *INDXA* that looks like Program D. It contains a blank index (except for line 90) and a Master Index, starting at line 1000, listing every program that I have on the tape (figure 2).

I load *INDXA* and enter into the Master Index the number of the new tape and the programs that it will contain. Then I dump a copy of this revised *INDXA* back on the original tape. I don't write it on top of the copy it came from though, a recording problem could leave you with no tape copy at all. I record it after the original, and if it checks out all right, then I record it on top of the original.

Even though I have dumped *INDXA* on tape, it still resides in memory. It has not been destroyed by writing it on tape. Now I go ahead and insert into lines 100 to 140 and 200 to 240 the names of the programs that will make up this new file. Then I enter program 2 starting at line 2000, program 3 starting at 3000, and so on for as many programs as there are. After testing everything, I name this file with a *REMARK* statement on line 5 and write it onto a new tape twice. I also make two hard copies of each file for reference and as an added precaution against accidental erasure.

All that is left to do is to update the Master Index in each of the existing tape files. I do this by loading each file tape, correcting the Master Index, and then saving it back on the tape that it came from. Again, I always have two copies of each file on a tape. Once I have updated a file, I record it on top of the second copy, test it, and then record it on top of the first copy.

It pays to be careful. A lot of work can go down the drain in a hurry. Even with a paper copy, you have a lot of typing ahead of you to resurrect an erased file. I break the record protect tabs off all of my cassettes and then place tape over them only when I specifically want to record.

The Magazine Software Tape Catalogue

This project takes more research than the Master Index but, once it is on tape, it is much easier to keep up to date, since you only have two copies to worry about. I suppose that most of you have read a magazine article on software and thought you'd like to try

PROGRAM A

The naked listing for the "BASIC Routine File Index." By filling in the blanks in lines 100 to 140, 200 to 240, and 1000 to 20000, you will create an easily accessible file of programs.

```
10 REMFILE INDEX "INDXA" MASTER COPY
20 PRINT TAB(17);"BASIC ROUTINE FILE INDEX"
30 PRINT TAB(20);"(C) COPYRIGHT 1977"
40 PRINT TAB(15);"BY ROD HALLEN TOMBSTONE, AZ"
50 CLEAR : PRINT
60 PRINT TAB(5);"*- - - - - - - - - - - - - - - - - - - - - - - - -*"
70 PRINT "#              ROUTINE";TAB(32);"#              ROUTINE"
80 PRINT
90 PRINT "0.....BASIC";TAB(32);"1.....MASTER INDEX"
100 PRINT "2.....              ";TAB(32);"3.....              "
110 PRINT "4.....              ";TAB(32);"5.....              "
120 PRINT "6.....              ";TAB(32);"7.....              "
130 PRINT "8.....              ";TAB(32);"9.....              "
140 PRINT "10.....             ";TAB(32);"11.....PAGE TWO"
150 PRINT : PRINT : INPUT "WHICH ROUTINE DO YOU WANT ? ",R
160 ON R GOTO 1000,2000,3000,4000,5000,6000,7000,8000,9000,10000,190
170 IF R=0 THEN END
180 PRINT "IMPROPER REQUEST. TRY AGAIN!": GOTO 50
190 PRINT : PRINT : PRINT "#              ROUTINE";TAB(32);"#              ROUTINE"
200 PRINT "11.....             ";TAB(32);"12.....              "
210 PRINT "13.....             ";TAB(32);"14.....              "
220 PRINT "15.....             ";TAB(32);"16.....              "
230 PRINT "17.....             ";TAB(32);"18.....              "
240 PRINT "19.....             ";TAB(32);"20.....              "
250 PRINT : PRINT : INPUT "WHAT ROUTINE DO YOU WANT ?",R
260 ON R-10 GOTO 11000,12000,13000,14000,15000,16000,17000,18000,19000,20000
270 GOTO 170
1000 GOTO 180
2000 GOTO 180
3000 GOTO 180
4000 GOTO 180
5000 GOTO 180
6000 GOTO 180
7000 GOTO 180
8000 GOTO 180
9000 GOTO 180
10000 GOTO 180
11000 GOTO 180
12000 GOTO 180
13000 GOTO 180
14000 GOTO 180
15000 GOTO 180
16000 GOTO 180
17000 GOTO 180
18000 GOTO 180
19000 GOTO 180
20000 GOTO 180
```

PROGRAM B

Modifications to be used in Program A if it will not fit your BASIC. Lines 160 to 171 replace 160 and 170, and lines 260 to 269 replace 260.

```
160 IF R=1 THEN 1000
161 IF R=2 THEN 2000
162 IF R=3 THEN 3000
163 IF R=4 THEN 4000
164 IF R=5 THEN 5000
165 IF R=6 THEN 6000
166 IF R=7 THEN 7000
167 IF R=8 THEN 8000
168 IF R=9 THEN 9000
169 IF R=10 THEN 10000
170 IF R=11 THEN 190
171 IF R=0 THEN END
```

```
260 IF R=11 THEN 11000
261 IF R=12 THEN 12000
262 IF R=13 THEN 13000
263 IF R=14 THEN 14000
264 IF R=15 THEN 15000
265 IF R=16 THEN 16000
266 IF R=17 THEN 17000
267 IF R=18 THEN 18000
268 IF R=19 THEN 19000
269 IF R=20 THEN 20000
```

PROGRAM C
Various ways of ending each of the routines in INDXA. Pick the one that fits your BASIC.

```
2000 REMDICE GAME
2990 INPUT "TYPE 0 FOR BASIC, 1 FOR DICE, AND 2 FOR INDEX. ? ",W
2995 ON W GOTO 2000,50
2999 END
3000 REMSLOTS GAME
3990 INPUT "TYPE 0 FOR BASIC, 1 FOR SLOTS, AND 2 FOR INDEX. ? ",W
3995 ON W GOTO 3000,50
3999 END
```

```
2000 REMDICE GAME
2990 PRINT "TYPE 0 FOR BASIC, 1 FOR DICE, AND 2 FOR INDEX.",
2991 INPUT W
2992 IF W=1 THEN 2000
2993 IF W=2 THEN 50
2999 END
3000 REMSLOTS GAME
3990 PRINT "TYPE 0 FOR BASIC, 1 FOR SLOTS, AND 2 FOR INDEX.",
3991 INPUT W
3992 IF W=1 THEN 3000
3993 IF W=2 THEN 50
3999 END
```

Figure 1
This is a run of INDXA. Entering the number of any of the games will force a jump to that game.

```
BASIC ROUTINE FILE INDEX
(C) COPYRIGHT 1977
BY ROD HALLEN TOMBSTONE, AZ

*.........................*

#          ROUTINE          #          ROUTINE

0.........BASIC             1.........MASTER INDEX
2.........DICE              3.........SLOTS
4.........CRAPS             5.........ARTILLERY
6.........PLOT              7.........LUNAR L
8.........MATCHES           9.........SPACE
10........BLACK JK          11........PAGE TWO

WHICH ROUTINE DO YOU WANT ? 11

#          ROUTINE          #          ROUTINE

11........ROULETTE          12........HIGH-LOW
13........DIAMOND           14........REVERSE
15.......                   16.......
17.......                   18.......
19.......                   20.......

WHAT ROUTINE DO YOU WANT ?0
READY
```

the program presented when you get a chance. Six months later you can recall the article, but not where it can be found. A lot of magazine scanning follows.

A better way is to go through your collection of magazines and books just once. Decide on some categories to place the programs in and then make a list of all the programs that you have in your library.

I started mine by heading a separate sheet of paper with each of the categories that I would need. As I went through the magazines and books, I decided where each program fit and entered it on the appropriate sheet along with the magazine name, date, and page number. I also devised a simple code to indicate what language the program was written in and whether I already had a copy (see table 1).

When my research was finished, I wrote and entered the program I call *LIBRC* (Program F). Now the fun of building up my catalogue began. Since many of the program names were not suggestive of their true purpose, I often listed them with a psuedoname which better identified them (see figure 3). And for this reason, I did not try to alphabetize within a category.

I had many pages of programs, and they weren't all catalogued and entered in one day. Whenever I grew tired of typing (for me that is often!), I dumped a temporary hard copy and two tape copies. This allowed me to pick up where I left off when I felt like it.

Each time I receive a new magazine or book that contains software, I enter them on the appropriate written list. When I find time, I load the catalogue, update it, and make hard copies and two tape copies.

Now, when I am in need of a program or just looking for ideas, I load *LIBRC* and browse through it. I almost always find something interesting that I had forgotten but now want to add to my tape files. I am seriously considering a similar catalogue for hardware articles, but my software interests keep me too busy right now.

The initial creation of all these files, catalogues, and indexes requires a certain amount of drudgery but, once they are on tape, your personal computing will be simpler, easier, and much more enjoyable. After all, why not let your computer keep track of things for you? It's better at it than you are. ▼

PROGRAM D

A listing of INDXA, with an example of the Master Index in lines 1000 to 1272. Line 1130 is the start of page two of the Master Index. Page three would start at 1280. As many pages as needed can be added.

```
 10 REMFILE INDEX "INDXA" MASTER COPY
 20 PRINT TAB(17);"BASIC ROUTINE FILE INDEX"
 30 PRINT TAB(20);"(C) COPYRIGHT 1977"
 40 PRINT TAB(15);"BY ROD HALLEN TOMBSTONE, AZ"
 50 CLEAR : PRINT
 60 PRINT TAB(5);"*- - - - - - - - - - - - - - - - - - - - - - - - *"
 70 PRINT "#              ROUTINE";TAB(32);"#              ROUTINE"
 80 PRINT
 90 PRINT "0.........BASIC";TAB(32);"1.........MASTER INDEX"
100 PRINT "2.........              ";TAB(32);"3.........              "
110 PRINT "4.........              ";TAB(32);"5.........              "
120 PRINT "6.........              ";TAB(32);"7.........              "
130 PRINT "8.........              ";TAB(32);"9.........              "
140 PRINT "10........              ";TAB(32);"11........PAGE TWO"
150 PRINT : PRINT : INPUT "WHICH ROUTINE DO YOU WANT ? ",R
160 ON R GOTO 1000,2000,3000,4000,5000,6000,7000,8000,9000,10000,190
170 IF R=0 THEN END
180 PRINT "IMPROPER REQUEST. TRY AGAIN!": GOTO 50
190 PRINT : PRINT : PRINT "#              ROUTINE";TAB(32);"#              ROUTINE"
200 PRINT "11........              ";TAB(32);"12........              "
210 PRINT "13........              ";TAB(32);"14........              "
220 PRINT "15........              ";TAB(32);"16........              "
230 PRINT "17........              ";TAB(32);"18........              "
240 PRINT "19........              ";TAB(32);"20........              "
250 PRINT : PRINT : INPUT "WHAT ROUTINE DO YOU WANT ?",R
260 ON R-10 GOTO 11000,12000,13000,14000,15000,16000,17000,18000,19000,20000
270 GOTO 170
1000 REMMASTER INDEX MASTER COPY
1010 PRINT : PRINT : PRINT TAB(18);"MASTER INDEX-GAMES"
1020 PRINT : PRINT "DICE-TAPE-3B";TAB(22);"SLOTS-TAPE-3B";TAB(43);"CRAPS-TAPE-3B"
1030 PRINT "ARTILLERY-TAPE-3B";TAB(22);"PLOT-TAPE-3B";TAB(43);"LUNAR L-TAPE-3B"
1040 PRINT "MATCHES-TAPE-3B";TAB(22);"SPACE-TAPE-3B";TAB(43);"BLACK JK-TAPE-3B"
1050 PRINT "ROULETTE-TAPE-3B";TAB(22);"HIGH-LOW-TAPE-3B";TAB(43);"DIAMOND-TAPE-3B"
1060 PRINT "REVERSE-TAPE-3B";TAB(22);"KLINGON-TAPE-4B";TAB(43);"CHASE-TAPE-4B"
1070 PRINT "DEFLECTION-TAPE-5A";TAB(22);"CHASE-TAPE-5A";TAB(43);"OTHELLO-TAPE-4B"
1080 PRINT "GRAPH-TAPE-5A";TAB(22);"MASTERMIND-TAPE-4B";TAB(43);"ROCKET-TAPE-4B"
1090 PRINT "BOMBER-TAPE-4B";TAB(22);"BLKJK1-TAPE-4B";TAB(43);"BINGO-TAPE-4B"
1100 PRINT "TOWER-TAPE-4B";TAB(22);"KINEMA-TAPE-4B";TAB(43);"DOGS-TAPE-4B"
1110 PRINT "CUBE-TAPE-4B";TAB(22);"POKER-TAPE-4B";TAB(43);"TRAP-TAPE-4B"
1120 PRINT : INPUT "TYPE 0 FOR BASIC, 1 FOR MORE MASTER INDEX, AND 2 FOR FILE INDEX. ?",W
1121 IF W=1 THEN 1130
1122 IF W=2 THEN 50
1123 END
1130 PRINT : PRINT TAB(18);"MASTER INDEX-MORE GAMES"
1140 PRINT
1270 PRINT : INPUT "TYPE 0 FOR BASIC, 1 FOR MORE MASTER INDEX, AND 2 FOR FILE INDEX. ? ",W
1271 IF W=1 THEN 1280
1272 IF W=2 THEN 50
1273 END
1999 END
2000 GOTO 180
3000 GOTO 180
4000 GOTO 180
5000 GOTO 180
6000 GOTO 180
7000 GOTO 180
8000 GOTO 180
9000 GOTO 180
10000 GOTO 180
11000 GOTO 180
12000 GOTO 180
```

```
13000 GOTO 180
14000 GOTO 180
15000 GOTO 180
16000 GOTO 180
17000 GOTO 180
18000 GOTO 180
19000 GOTO 180
20000 GOTO 180
```

PROGRAM E

LIBRC, the "Master Software Library Catalogue." An example of one page of the catalogue is contained in lines 1000 to 1139. Page two starts at 1140, and page three would start at 1280. As many pages as needed can be added.

```
   10 REMFILE LIBRARY "LIBRC" MASTER COPY
   20 PRINT TAB(15);"MASTER SOFTWARE LIBRARY CATALOG"
   30 PRINT TAB(20);"(C) COPYRIGHT 1978"
   40 PRINT TAB(15);"BY ROD HALLEN TOMBSTONE, AZ "
   50 CLEAR : PRINT
   60 PRINT TAB(5);"*- - - - - - - - - - - - - - - - - - - - - - - - -*"
   70 PRINT "#            CATEGORY";TAB(32);"#            CATEGORY"
   80 PRINT
   90 PRINT "0.....BASIC";TAB(32);"1.....GAMES"
  100 PRINT "2.....FINANCE ";TAB(32);"3.....UTILITY "
  110 PRINT "4.....ARTIFICIAL INTELL";TAB(32);"5.....MATH"
  120 PRINT "6.....ASTRONOMY";TAB(32);"7.....ENVIRONMENT"
  130 PRINT "8.....SOLAR ENERGY";TAB(32);"9.....MUSIC"
  140 PRINT "10.....SPECIAL"
  150 PRINT : PRINT :   INPUT "WHICH CATEGORY DO YOU WANT?",R
  160 ON R GOTO 1000,2000,3000,4000,5000,6000,7000,8000,9000,10000
  170 IF R=0 THEN END
  180 PRINT "IMPROPER REQUEST. TRY AGAIN!": GOTO 50
 1000 PRINT : PRINT TAB(29);"GAMES"
 1010 PRINT
 1020 PRINT "DICE-TAPE3B";TAB(22);"SLOTS-TAPE3B";TAB(43);"ROULETTE-TAPE3B"
 1030 PRINT "LIFE-IA-577-135A";TAB(22);"STARS-IA-477-109B";TAB(43);"TICTAC-IA-877-170B"
 1040 PRINT "CRAZYB-IA-877-171B";TAB(22);"CHASE-IA-1077-164A";TAB(43);"INJUNP-IA-1277-159B"
 1050 PRINT "PIRANA-IA-1277-164A";TAB(22);"TAXMAN-IA-178-164B";TAB(43);"TAXMAN-IA-278-140B"
 1060 PRINT "RACE-KB-277-88B";TAB(22);"DRAW-KB-377-130B";TAB(43);"ARTILLERY-KB-677-34B"
 1070 PRINT "BOMB-KB-877-82B";TAB(22);"BASEBL-KB-977-100B";TAB(43);"CRASH-KB-1277-100B"
 1080 PRINT "STARTK-BY-976-40B";TAB(22);"START1-BY-377-106B";TAB(43);"WUMPUS-CC-#1-254B"
 1090 PRINT "DEPTHC-CC-#!-251B";TAB(22);"NOTONE-CC-#1-253B";TAB(43);"CIVILW-CC-#1-254B"
 1100 PRINT "SEAWAR-CC-#1-262B";TAB(22);"GEOWAR-CC-#!-266B";TAB(43);"SPLAT-CC-#1-268"
 1110 PRINT "ICBM-CC-#1-269B";TAB(22);"MAGICSQ-CC-#1-271B";TAB(43);"SSTREK-CC-#1-275B"
 1120 PRINT
 1130 INPUT "TYPE 0 FOR BASIC, 1 FOR MORE GAMES, AND 2 FOR INDEX. ?",W
 1131 IF W=1 THEN 1140
 1132 IF W=2 THEN 50
 1139 END
 1140 PRINT TAB(25);"GAMES   PAGE TWO"
 1145 PRINT
 1270 INPUT "TYPE 0 FOR BASIC, 1 FOR MORE GAMES, AND 2 FOR INDEX. ?",W
 1271 IF W=1 THEN 1280
 1272 IF W=2 THEN 50
 1279 END
 2000 GOTO 180
 3000 GOTO 180
 4000 GOTO 180
 5000 GOTO 180
 6000 GOTO 180
 7000 GOTO 180
 8000 GOTO 180
 9000 GOTO 180
 9999 END
10000 GOTO 180
```

Table 1
The abbreviations used in the tape catalogues. An *X* is added after the listing for any program that is already on tape. A two- to five-letter code can be used to indicate books.

A	=	8080 Assembly
F	=	FORTRAN
S	=	6800 Assembly
B	=	BASIC
M	=	6502 Assembly
Z	=	Z-80 Assembly
BY	=	BYTE
DD	=	dr. dobb's journal
KB	=	Kilobaud
PC	=	Peoples Computers
CC	=	Creative Computing
IA	=	Interface Age
73	=	73
SC	=	SCCS Interface

Figure 2
INDXA with the first page of the Master Index shown. This is a run of Program D.

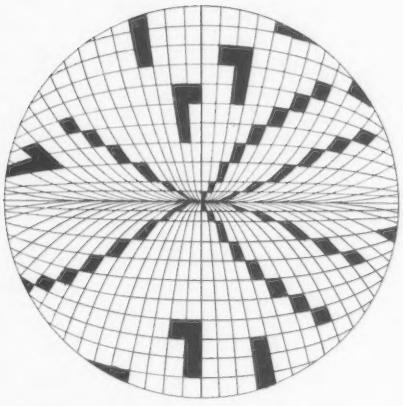
```
BASIC ROUTINE FILE INDEX
(C) COPYRIGHT 1977
BY ROD HALLEN TOMBSTONE, AZ

*.......................*
#          ROUTINE        #          ROUTINE

0.........BASIC           1.........MASTER INDEX
2.........                 3.........
4.........                 5.........
6.........                 7.........
8.........                 9.........
10........                 11........PAGE TWO

WHICH ROUTINE DO YOU WANT ? 1

                    MASTER INDEX-GAMES

DICE-TAPE-3B          SLOTS-TAPE-3B          CRAPS-TAPE-3B
ARTILLERY-TAPE-3B     PLOT-TAPE-3B           LUNAR L-TAPE-3B
MATCHES-TAPE-3B       SPACE-TAPE-3B          BLACK JK-TAPE-3B
ROULETTE-TAPE-3B      HIGH-LOW-TAPE-3B       DIAMOND-TAPE-3B
REVERSE-TAPE-3B       KLINGON-TAPE-4B        CHASE-TAPE-4B
DEFLECTION-TAPE-5A    CHASE-TAPE-5A          OTHELLO-TAPE-4B
GRAPH-TAPE-5A         MASTERMIND-TAPE-4B     ROCKET-TAPE-4B
BOMBER-TAPE-4B        BLKJK1-TAPE-4B         BINGO-TAPE-4B
TOWER-TAPE-4B         KINEMA-TAPE-4B         DOGS-TAPE-4B
CUBE-TAPE-4B          POKER-TAPE-4B          TRAP-TAPE-4B

TYPE 0 FOR BASIC, 1 FOR MORE MASTER INDEX, AND 2 FOR FILE INDEX. ?0
READY
```

Figure 3
This is a run of Program E showing the first page of the games catalogue. (See table 1 to decode the last letter of each program listing.)

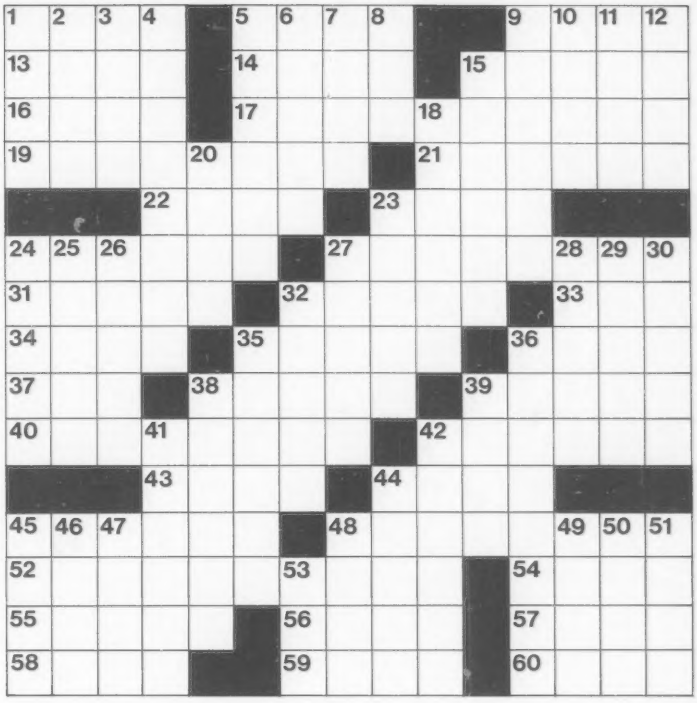
```
MASTER SOFTWARE LIBRARY CATALOG
(C) COPYRIGHT 1978
BY ROD HALLEN TOMBSTONE, AZ

*.......................*
#          CATEGORY       #          CATEGORY

0.........BASIC           1.........GAMES
2.........FINANCE         3.........UTILITY
4.........ARTIFICIAL INTELL 5.......MATH
6.........ASTRONOMY       7.........ENVIRONMENT
8.........SOLAR ENERGY    9.........MUSIC
10........SPECIAL

WHICH CATEGORY DO YOU WANT ?1

                         GAMES

DICE-TAPE3B           SLOTS-TAPE3B           ROULETTE-TAPE3B
LIFE-IA-577-135A      STARS-IA-477-109B      TICTAC-IA-877-170B
CRAZYB-IA-877-171B    CHASE-IA-1077-164A     INJUNP-IA-1277-159B
PIRANA-IA-1277-164A   TAXMAN-IA-178-164B     TAXMAN-IA-278-140B
RACE-KB-277-88B       DRAW-KB-377-130B       ARTILLERY-KB-677-34B
BOMB-KB-877-82B       BASEBL-KB-977-100B     CRASH-KB-1277-100B
STARTK-BY-976-40B     START1-BY-377-106B     WUMPUS-CC-#1-254B
DEPTHC-CC-#!-251B     NOTONE-CC-#1-253B      CIVILW-CC-#1-254B
SEAWAR-CC-#1-262B     GEOWAR-CC-#!-266B      SPLAT-CC-#1-268
ICBM-CC-#1-269B       MAGICSQ-CC-#1-271B     SSTREK-CC-#1-275B

TYPE 0 FOR BASIC, 1 FOR MORE GAMES, AND 2 FOR INDEX. ?0
READY
```

Hands on!

A Computer-oriented Crossword Puzzle



by Terry Winter Owens



DEFINITIONS

ACROSS:

1. NCR Programming Language
5. ROM unaffected by power down
9. Type of auxiliary storage (abbr.)
13 Suffix used in zoology
14 Future means of communicating with a computer
15 Woman's name
16 Conditional breakpoint
17 Unit of information to be processed
19 Location of entry on punch card
21 Slip away
22 Supplemental index
23 Condition of CRT
24 Pulse selection process
27 Gluttonizes
31 Nimble
32 Salty
33 Pasha
34 Auntie ----
35 Biased person
36 Man's name (abbr.)
37 American Indian tribe
38 Women: German
39 Russian composer (abbr.)
40 IPUT/Output device
42 Blanks
43 Legislative body (abbr.)
44 Man's name
45 Gallery
48 Automated searchers
52 Subroutine relating to information reading
54 IF ...; THEN ...; _____
55 Inpute ----
56 Ancient Egyptian
57 Electrically charged
58 Consider
59 Sheep
60 Drains strength

DOWN

1. Naut. measurement
2. Pertaining to the extremities
3. Sea animal
4 Machine readable form of data
5 Translation of flow chart to computer language
6 Present a speech
7 Baud ----
8 High note
9 Type of resistor box
10 Crooked
11 Gentlemen
12 County in Florida
15 Green vegetable
18 Member of governing board
20 Geometric function
23 Par ---- (French air mail)
24 Entire range
25 Marble
26 Monitoring or controlling device
27 Musical instrument: German
28 Special: Latin
29 Taunt
30 Procedural plans (abbr.)
32 Shift register element
35 Forbidden
36 Tape levels
38 One directional electronic device
39 Distance
41 Scottish inventor of road surfacing
42 Initiates operation
44 Group of Honeywell routines
45 Educational institution (abbr.)
46 Unusual
47 Indian tribe
48 Store
49 Man's name
50 Invitational abbreviation
51 Observes
53 State of H_20

ROBOT PROGRAMMING: Not As Easy As It Looks

There are many steps in programming a robot for a simple function. It all *looks* very simple in the beginning.

Arthur Karshmer

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Amherst, MA 01002

What comes to your mind when people talk about the Problems of Industrial Societies? Myself, I invariably visualize poor Charlie Chaplin in *Modern Times*, driven berserk by the brain-numbing repetitiousness of his work on the assembly line. Tightening ten thousand nuts a day is clearly not what four million or so years of human evolution have fit us for. It's boring. Mechanical. Dehumanizing.

Well, then, why not literally *dehumanize* such jobs? Replace the all-too-human Charlie Chaplin with an industrial robot that will do the job at least as well, and won't ever have occasion to file a Workmen's Compensation claim for occupational neurosis. More humane all around, and potentially much cheaper.

But, alas, not as easy as it seems. As every programmer knows, many seemingly simple tasks — tasks which could be accomplished without the slightest trouble by a slow five year old — reveal layer beneath layer of stubborn complexity when one attempts to specify them algorithmically.

Perceptual-motor tasks especially, even the most boring and "mechanical" of them, like Chaplin's job, tend to be of this deceptive sort. Those four million-odd years (many more, really, if you count in our pre-human lineage) have built into us an automatic perceptual-motor processor of such formidable flexibility and power that it can take quite a lot of reflection to convince yourself that there is anything particularly remarkable about, say, a child's ability to stack up a tower of blocks — unless it is your *own* child's ability. That, of course, is marvelous.

To get a picture of the complexity of some of the tasks that must be mastered by any successful, general-purpose assembly line robot, let's take a closer look at this childishly simple task of block stacking, a "classical" problem that has served as a testbed for many ideas in AI software design.

Suppose a robot is faced with the configuration of blocks diagrammed in Figure 1. It is given the *goal* of stacking up the blocks as shown in Figure 2, with A on top, B in between, and C at the bottom.

What must the robot be able to do in order to attain its goal?

It must, in the first place, be able to *sense* and to *"understand"* its world. If its TV-camera eye delivers an image of the scene in Figure 1, it must be capable of segmenting the sense into appropriate regions and contours, to group these into meaningful *objects* (the blocks, its own hand, the table, etc.), and to compute relevant *predicates*, i.e., properties of individual objects (such as position coordinates, alphabetical labels "A," "B," "C," Hand *empty*) or relations among objects C *on top of* A, B *on top of* Table, etcetera).

In the second place, the robot's control program must be equipped with data structures rich enough to *represent* all the possible situations that may occur in its world, as well as its own goals and whatever information it may require about its own internal state. It must have procedures for testing the current situation against its goals and for choosing a sequence of *opertors* that will transform the current situation, step by step, into a situation that satisfies the goals. The process of computing such a sequence of operators is generally called *robot planning* or *robot problem solving.*

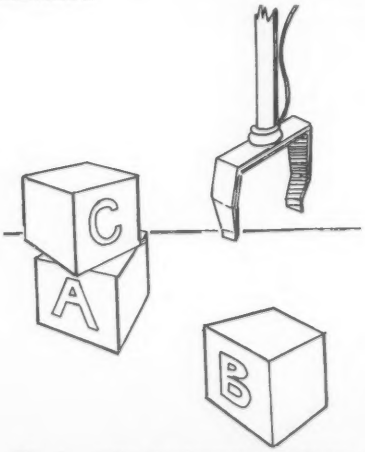

Fig. 1. *Initial Configuration of Blocks with Schematic Robot Arm.*

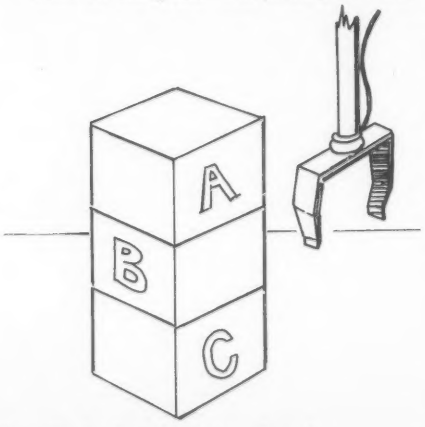

Fig. 2. *Goal: Stack A on B on C.*

Finally, the robot must possess the motor apparatus and control mechanisms to execute, accurately and reliably, the sort of actions called for by the planning program. In our block stacking example, for instance, the robot hand must be able to grasp blocks, let them go, move them from place to place, and so on.

I don't want to dwell upon the design of motor effectors for robots nor upon the equally fascinating problems of robot visition. Instead I'd like to step through a greatly simplified example of the process of robot planning, to give you a taste of the sort of problem that current planning systems must confront. We'll consider one system in particular and see how it can be applied to the block-stacking problem domain.

The system is called STRIPS (Stanford Research Institute Problem Solver). It was developed almost ten yers ago by Richard Fikes and Nils Nilsson at SRI, where it was used to plan the behavior of Shakey, SRI's experimental mobile robot, now retired. STRIPS is by no means a practical system for industrial robotics; it is, rather, the most influential product of the first generation of robot planning research, and an excellent system for illustrating some of the issues of representation and influence that arise in robotics.

STRIPS models the problem environment as a sequence of *situations*, starting with an *initial situation.* It applies *operators* to transform each situation to the next on its way to a situation that satisfies a *goal* with which it has been supplied. A STRIPS situation is represented as a set of statements in the *first-order predicate calculus*, a simple, nearly self-explanatory logical formalism which is readily amendable to automatic proof procedures. In our example, the initial situation shown in Figure 1 might be coded as:

CLEARTOP (B) AT (Hand, (xo, yo, zo))

CLEARTOP (C) AT (A, (xA, yA, zA))

ON (A, Table) AT (B (xB, yB, Bz, B))

ON (B, Table) AT (C, (xC, yC, zC))

ON (C, A) HANDEMPTY

where the predicate ON (X,Y) means "object X is on top of object Y"; the predicate AT (X, (x, y, z)) means "(some prespecified reference point of) object X is at the point with coordinates (x, y, z)"; and CLEARTOP (X) means "object X has nothing resting on top of it." HANDEMPTY is a predicate that is true just in case the robot's hand isn't holding anything. When it is holding something, say block X, then HANDEMPTY becomes false and another predicate, HOLDING (X), is asserted.

Part of the definition of every situation in a given problem domain are certain *axioms* which express general properties of situations and operators in that domain. For example, some axioms in the block stacking domain might be:

(VX) (CLEARTOP (X) (Y) (-ON (Y,X)) an
(VX) HANDEMPTY HOLDING (X)).

In the concise notation of the predicate calculus the first axiom means "for every object X, if X has nothing on top of it, then for every object Y, Y is not on top of X." Trivially obvious to us, but to STRIPS it

expresses a relation between the predicates and CLEARTOP and ON that is crucial to the kind of logical inferences that must be performed in the process of planning. (What does the other axiom mean?)

Goals are also expressed in the predicate calculus formalism. We can represent the goal shown in Figure 2 as the set of statements:

ON (A, B)
ON (B, C)

Notice that this is not a complete description of the situation. In general, a goal will specify a collection of properties that could be possessed by many particular situations. For example, our goal does not prescribe a *position* for block C, so the tower can be built anyplace we want to put it.

A STRIPS *operator* models an action that the robot performs upon the environment. It is defined by four components:

1) a *name*, together with a list of *parameters* that refer to objects;
2) a list of *preconditions*, predicate calculus statements that must be satisfied before the operator can be applied;
3) a *delete list* of predicates whose truth values might be changed by the operation; and
4) an *add list* of statements that become true after application of the operator.

For our example an appropriate set of operators might be the following:

GRASP (X)
preconditions: HANDEMPTY
CLEARTOP (X)
delete: HANDEMPTY
AT (Hand,
old cordinates of hand)
add: HOLDING (X)
AT (Hand,
coordinates of X)

RELEASE (X)
preconditions: HOLDING (X)
delete: HOLDING (X)
add: HANDEMPTY

MOVE ((x, y, z))
preconditions: none
delete: AT (Hand,
old coordinates of hand)
add: AT (Hand, (x, y, z))

Supplied with these operators, and with the initial situation and goals expressed as predicate calculus formulas, how does STRIPS go about constructing a plan? At the heart of the method is an *automatic theorem proving* program. Its details are much too involved to go into here — the study of such programs is a highly technical subfield of AI research — but its function in STRIPS planning is straightforward. Taking the axioms and the statements describing the initial situation as premises, STRIPS treats the goal statement as a *theorem* to be proved true. If the goal statement cannot be shown by the theorem prover to be provable in the initial situation (the usual case, else why bother?) then STRIPS looks for an operator that would, if it were applied, make some part of the goal provable. In the simplest case, such an operator might have a predicate belonging to the goal statement as a member of its add list. If the operator were applied, that predicate would become true and part of the goal would thereby be made provable.

In order to apply the operator, STRIPS must first make sure that all of its *preconditions* are satisfied by the current situation. If any of them are not, then STRIPS takes those, in turn, as *subgoals*, and proceeds in exactly the same fashion to establish *their* provability from the initial situation. In this way, working backwards from the goal. STRIPS strings together a sequence of operators that transforms the initial situation, step by step, into one in which the goal statement is satisfied, each operator setting up preconditions necessary for application of the next. If the goal statement is complex, such a sequence may have to be constructed for each of its parts. This can lead to the problem of *subgoal interaction*, in which operations that help to establish one portion of a goal may interfere with the attainment of another portion. How to deal with this problem is a current hot area of AI research.

That, in barest outline, is how STRIPS and related programs do robot planning. Though I have barely touched the surface of these ingenious systems, you can see that there is a lot more involved in even the "ABC"s of playing with blocks than meets the casual eye.

Yet, for people it all seems so easy. Try it yourself. Using only your common sense for aximons, and the predicate calculus descriptions I gave above for the initial situation (Figure 1) and the goal (Figure 2), see how long it takes you to come up with a plan, a sequence of operators from the list of three I suggested, that transforms the initial situation into one satisfying the goal. (Don't worry about formal details; I haven't provided enough machinery for real rigor.) You will find that your intuition jumps to the answer immediately, but if you take the trouble to write out the effects on the situation of each step of the plan and ask yourself how STRIPS would have to cmpute the next step, you will be made vividly aware of how much of your own brains' computation you are taking for granted. ■

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THE LAST LAUGH?

by Bill Etra

Will the Luddites really have the last laugh? Consider automation today and you face a potential problem much greater than the Scottish mill workers could ever have dreamed of: the microprocessor. This electronic wonder is becoming more intelligent, and its labor-saving applications broader and broader, with every passing generation. Even so, its store of energy and power is still largely untapped. Look how far the 8080 microprocessor has come. And yet, with its full potential still not exploited, it's about to be replaced by something more powerful: the 8086, a sixteen-bit version. The Z-80 will be replaced with the Z-4000, or whatever they're calling their new equivalent. And so on. A flood of sixteen-bit chips will hit the market.

Even with all this power, real and unrealized, will the micro give the Luddites their last laugh? Personally I'm not so sure. In fact, I still haven't really figured out what to do with a computer, though I've been asked about it often enough. For instance, a couple of years ago, I was visited by a young lady interviewer from *New York* magazine who had been advised by a friend that the place to find a lot of technology in a New York apartment was my home. Which was true enough. We had several home computers, among them a Tektronix 4051 and an Altair, as well as terminals on the Columbia University and City University of New York systems. We had an Advent video projector and a stack of analog computers for my work in video synthesis. The lady's opening remark on entering my apartment was "This place isn't designed." Now perhaps the place was a bit cluttered, still.... It was all downhill from there.

One of the young lady's first questions was "Does your computer run your toaster?" The answer was that we didn't have a toaster. I explained that in any case I had no desire to have my computer turn my toaster on and off, that I didn't want my toast to pop up with me in the morning, and that I especially didn't want my computer to pop me out of bed—I'd had enough trouble with all the alarm clocks I'd thrown against the wall over the years. I certainly didn't want to treat my home computer that way.

The lady's next question was "Does it balance your checkbook?" To that one I answered, "No, we wait until the checks bounce like everybody else." She seemed startled. "Oh, I thought you would do it differently." Why? Most people balance their checkbooks with a pencil. Primitive as this computational device may be, when attached to the human brain it's quite adequate for the job.

So what *do* you do with a home computer? The Radio Shack home computer comes complete with a lovely recipe calculator. But what happens when it calls for a third of an egg? More importantly, does it get you much beyond the standard recipe file? The computer does not as yet plug into the Waring blender, automatically turning it on for three seconds as required. Even if it did, you can count to three, can't you?

What lurks behind many of the ideas people have about personal computers and micro-controlled time-saving devices is what I would like to call the 1920s, 1930s vision of the home of the future: the house that runs itself. Thinking of home computers in these terms is a misconception, and it's been a misconception for a long time. Fritz Lang, in *Metropolis,* the early science-fiction film, makes people slaves to the machine. People move the dials as the machine instructs them to—essentially they're matching dials. What Lang failed to understand is that the machine is quite capable of setting its own dials. The horrible scene where the man is trying desperately to keep up with the machine's instructions on how to set the dials isn't really necessary. What man is needed for is to check for machine errors. Since these are likely to be infrequent, one man can watch many machines.

This brings us to the real crux of the up-and-coming social problem: adapting to the increasing takeover by computers of the tasks they do well. For instance, they can run a lot of heavy, dangerous machinery that people are less adept at handling or operate less economically. The reason computers often don't run these machines now is partly a labor problem. You just have to have something to give people to do when they come into the factory in the morning. We have a social system involving unions and laborers. Some of these laborers have already been replaced, to all intents and purposes, by technology for the sake of operating efficiency. But, among other things, a machine can't join the union, or at least it can't pay the dues. So you have factories with thirty to fifty percent extra staff. For the superfluous worker, it's demeaning, because he ends up counting stacks of cartons in the corner. I've actually seen a punch press in operation where the press was kept slightly off kilter. No one ever bothered to fix it because it left the workers something to do. They hammered out by hand the die cuts that weren't properly pressed out. There wasn't anything else in the factory to occupy them.

I didn't want my toast to pop up with me in the morning, and I didn't want my computer to pop me out of bed.

In the perfect social system, these machine-redundant people would have meaningful jobs within the new technology. They would be employed in jobs relating to producing the new technology. Computers are still designed by humans, after all. Even in computer factories, where computers are producing computers, human supervision is necessary. We don't have computers that replace the human brain. We don't have cameras that replace the human eye, in terms of, say, checking for errors.

On the other hand, we *can* replace the human eye in specific instances where we know what we're looking for; a lot of automation is a matter of reducing physical problems and knowing what to look for. Machines can scan some things for errors better than human beings can check them with their eyes. So there's no reason for human energy to go into or be concerned with a lot of boring repetitive tasks—except that our current social order won't allow the jobs to be eliminated, no matter how redundant or boring they are. For instance, if you are a laborer in a union, your job is guaranteed. Of course it represents security. But it also may trap you in a job that is no longer desirable. Even if a company would like to retire you—give you full salary and have you not show up, have you do anything else you wanted to do—you still have to punch in. The union couldn't allow anything else, because in the end it might mean the elimination of that particular job once you were gone. The union, after all, has a life of its own.

Our traditional method of handling a problem like this is to blow everything up and bring it down to ground zero—destroy everything so we can rebuild it. And it's not a totally inefficient method. Part of the reason Japan and West Germany are doing so well, compared with Britain, is that they had a chance to replace all their technologies after the war. Britain and the United States didn't need to—or, more correctly, couldn't afford to replace more than part of theirs. The reason we have bad railroads, for instance, is that we had railroads early and they've more or less stood in their tracks. The railroads of Europe, on the other hand, have been blown up—not once, but several times—since they were first built. So they're much more up to date.

There is an advantage to starting new every few years: your technology doesn't become outmoded. What the steel mills in this country need is to be closed down, blown up, and rebuilt. The Japanese steel mills had that done for them. The new jobs in the new mills were geared to the new technology; no one lost face, the sociological problem was solved, and efficiency increased immensely.

In a parallel vein, China is just getting modern technology. As their society implements it fully, they will be in an economic position to compete favorably with the Western world and Japan. Starting at a much higher level will be wonderful for them.

It's very hard to replace an old technology when it is still working. This is one of our major problems, and how we handle it is more of a social question than anything else. Changing traditions takes longer than switching technologies. And at this stage it's bound to take longer no matter what we do, because technological development is running at a much higher rate than we could possibly hope our lives to adjust to.

The problem is severe, and there's really nothing to be done about it. But that doesn't mean we have to jump overboard in panic. Nor does it mean we should try to apply the new technologies to everything. There really is no need for a home computer to store recipes. And, let's face it, you really don't need a home computer to go through your stack of the last three years of *National Geographics* that you have. Among other things, it requires you to file them in logical order anyway.

On the other hand, there might be a practical use for a home computer that could teach cooking and how it works. It's nice to know something about the chemistry of cooking, like why eggs get hard when you boil them, for instance. Computers aren't bad teaching tools, especially if the teaching programs are interactive. When you get right down to it, in fact, the only thing I can think of for a home computer to do, really, besides playing video games, is to be an interactive teacher.

On an entirely different front, we have the advance of the small dedicated computers. Through them your car will soon talk to you, your refrigerator will talk to you, everything from your telephone to your Waring blender will probably talk, or at least whistle at you. There's already on the market a refrigerator with a built-in audio cassette; microprocessor control is only a year or two away.

Small dedicated machines can be very useful. They can control the heating system of your house, for instance. But controlling a thermostat is a very slow operation. A non-dedicated micro could be doing a hundred or a hundred thousand other things at the same time. The fact that it is not doing so seems to indicate that there is very little else we can find to keep them busy.

What it boils down to is that there are a lot of things people don't really want, even if they're marketed as dream gadgets by the media. You have to have a very regimented life, for instance, to have your computer prepare breakfast for you every morning, not to mention knowing what you want for breakfast. And you will need an awful lot of mechanical automation to get the computer to get the eggs out of the icebox and drop them into the frying pan on the stove. . . .

So though microcomputers will change our lives immensely, particularly our social structure, we may not be able to foresee the specifics accurately right now. What we can see clearly is that massive social adjustment over a rather protracted period of time will be required. And that in the long run the Luddites will probably not get their last laugh. ▼

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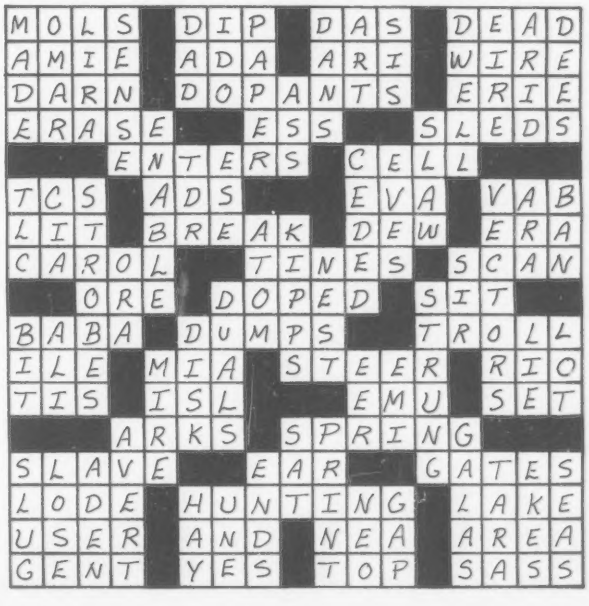

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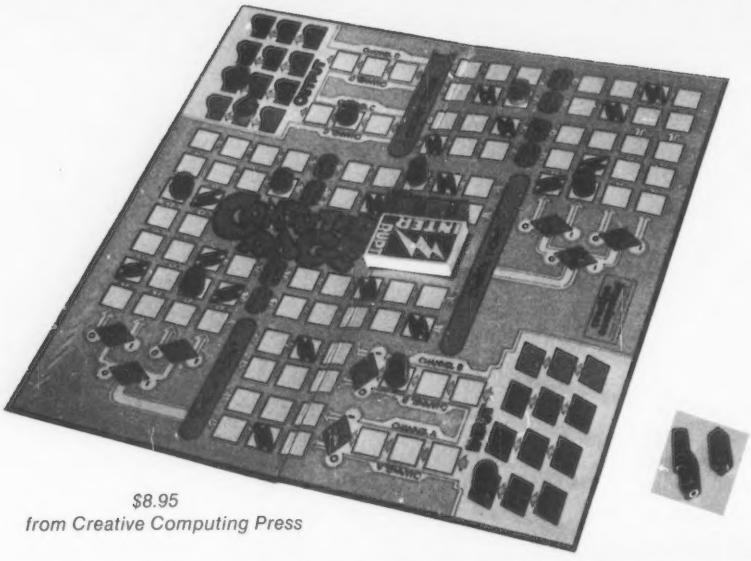

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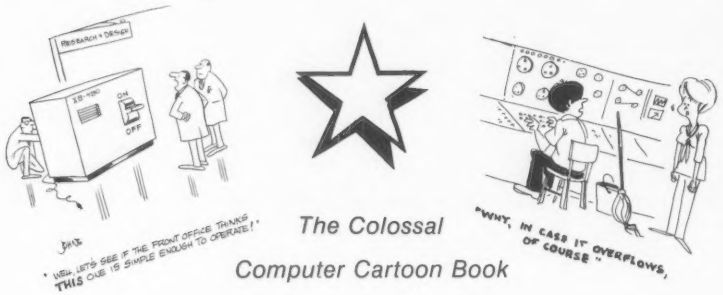

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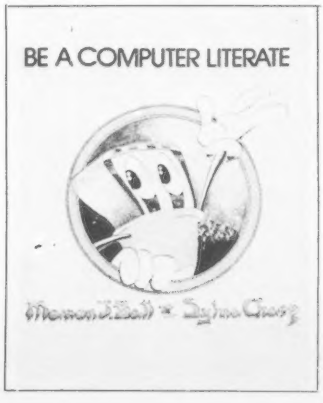

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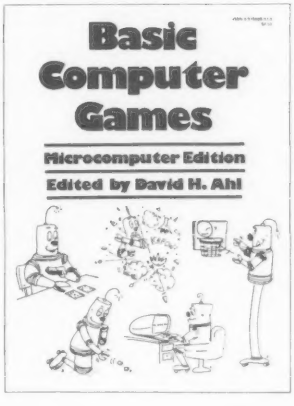

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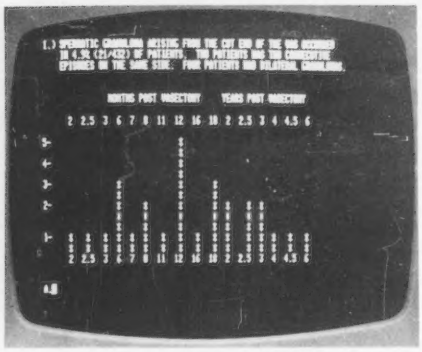

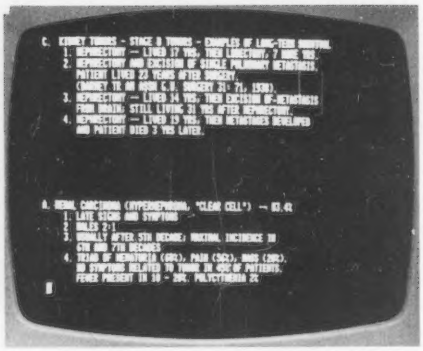

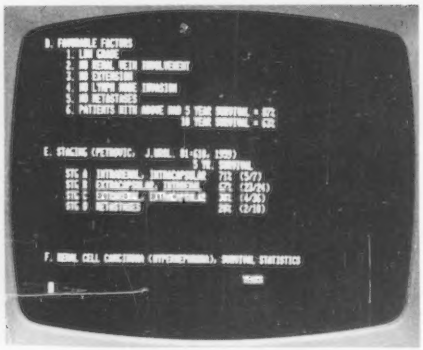

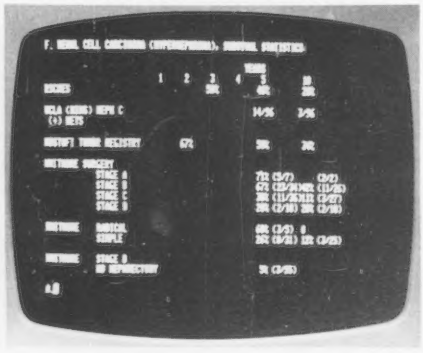

Microurologist

by Lee Felsenstein

How does a urologist end up a microcomputerist? Well, for Edmond D. Butler, Jr., M.D., it all began with the First West Coast Computer Faire held back in April 1977.

"I took my wife and children thinking it would be an enlightening experience," he explains, "because we do things like that together. And indeed it was. I went all three days, because I wanted to suck in as much as I could."

As a specialist in urology, a clinical professor of surgery at the Stanford medical school, and member of a clinic which handles some 80,000 patient visits a year, Dr. Butler is busy enough to want all his interests to be productive. At the same time, he has tried for many years to bring the potential power of computers to bear on the problems he faces in his profession. And at the Faire, Dr. Butler began to get a glimmer of how a new interest could become most productive.

As early as 1965, while in residence at the University of California Medical Center in San Francisco, Dr. Butler and a Dr. Govan had written a program to perform diagnoses of urologic ailments in patients suffering various states of paralysis resulting from spinal damage. Their essay on the system won a prize from the American Urologic Association. But they were using an IBM 7094 (a very big machine for the time), and Dr. Butler recalls that after a demonstration one of the urologists specializing in that area came up to him and told him that in ten minutes with a percussion hammer he could do just as much as the computer had done. Which was true. "That was Lesson One for me," Dr. Butler notes. "You don't ask the computer to do things that people can easily do using regular modalities."

Since that time, working in the FORTRAN programming language that he had learned while a medical student, Dr. Butler has developed time-saving programs to keep abstracts of professional literature and compacted patient data on the Stanford University IBM 370/168 (a very big machine even now). With his Lear Seigler ADM-3 video terminal and modem, he could hook into the Stanford computer by phone whenever he needed to refer to his data.

But he found it a great disadvantage to dial in and log on each time he wanted to get a piece of information. And he adds, "Although there was no limit to the amount of information I could store, there was a limit to the amount I could afford to store."

What Dr. Butler wants to do now is simple in concept, but rather more difficult in practice. "In the area of patient care, for instance," he explains, "I'd like to know how many bladder tumor patients I've got, what their status is right now, who hasn't come back for a follow-up examination. Sure, If you have a good card file system you can do that. People have done it for years. But you can't say on any given day what your series of patients is doing: how many are living, how many are living with tumor, how many need attention. You have no idea how you are doing in applying your particular mode of therapy. How do you compare with other series in the literature? Most people find, when reviewing their series, that they remember the good points but they forget about the times when they had an adverse result. You have to keep track of all your surgical cases, and the numbers and

Photographs by Garry L. Parrish

ically, Of Course

quantities of information you have to deal with are just enormous. The really good series in the literature, for example, go back fifteen years."

To help his project along, Dr. Butler obtained a series of small grants (from the Charles D. Armstrong Foundation, Envirotech, and *Sunset* Magazine). These financed the purchase of the Cromemco Z2-D system now residing in the hallway of his office suite. Dr. Butler selected the Cromemco system because he felt it was "the Cadillac of the industry." Also it had disk storage, with which he was familiar from the 370 system at Stanford. The fact that Cromemco was a local firm also turned out to be convenient when Dr. Butler had occasion to take the machine back for warranty repairs. "Cromemco was extremely kind," he comments. "I pushed them to the limit asking for more and more information. Dave Grus and Tom McCalmont there have taken time to give me individual service over and above what I deserved."

Currently, Dr. Butler is abstracting information on his patients and entering it in his files so that he can make quick searches for specific categories such as the type of ailment, level of severity, date of most recent procedure, and result of most recent examination. These one-line abstracts of patient data can be searched by a very small BASIC program rewritten by Tom McCalmont from an example in the book *Instant Freeze-Dried Computer Programming in Basic,* by Jerald R. Brown. Dr. Butler had just run up against the limitations of his system memory, however; a list of sixty patients is all that the BASIC will accommodate before overflowing its memory. "Now," Dr. Butler says, "I have to start learning how to use the *PUT* and *TAKE* functions so that I can keep the patient information on the disk rather than inside the program as *DATA* statements."

In addition to the patient record program, Dr. Butler is developing a demonstration tutorial program using the Z2-D text editor. The tutorial presents a refresher course in certain areas of urology using the video terminal display. Presently the user can control only the rate of display, asking for more when ready for another page, but Dr. Butler envisions a more elaborate and more interactive system for the future.

"The problem is," as Dr. Butler points out, "you never have enough time to read everything you want to read. You could train someone to enter, for instance, a title or a paragraph which you mark as something important that you want to use in your practice. Then, through the microcomputer, you could make it available through a good search-and-sort program, something like that." Dr. Butler believes the Office of Education of the American Urologic Association would be a good central point from which computer-readable abstracts and updates could be made available on floppy disks to colleague physicians. A physician with an office microcomputer could then review areas of literature of interest to him at his convenience rather than having to pour through a constant flow of journals.

Dr. Butler says of the system, "It's like an electronic filing cabinet, really. The microcomputer for me is a catalyst for doing things that I probably ought to be doing anyway, one of which is keeping up my filing cabinet. There are always things to be filed. There are things you can't find because they're filed under another category. Or you're storing whole articles when you really need only a single paragraph. Your cabinet is always full of all kinds of things that you either can't find or don't want.

"Of course," Dr. Butler says modestly, "all this has been done on big computers for a long time. What I'm doing is nothing that's going to shake the earth. But it hasn't been done in a private physician's office before. And what I'm hoping is that the microcomputer will serve as an incentive for me to get my act together. It's a marvelous excuse to use this system in a productive fashion." Sounds positively microurologistical. ▼

Dr. Butler's Sort Program

This program, which runs under Cromemco's Control BASIC, can also be modified to run under other BASICS having string variables. It displays all the data items that have the desired character string anywhere inside them. The program is provided courtesy of Tom McCalmont of Cromemco.

```
60 DIM N$(60),S$(25)
90 INPUT "FOR WHAT WORD DO YOU WISH TO SEARCH",S$
100 A=0
110 RESTORE : PRINT
310 FOR K=1 TO 16
330 READ N$
350 P=POS(N$,S$,0)
370 IF P=-1 THEN GOTO 410
380 Q=POS (N$," ",P)
390 GOSUB 900
410 NEXT K
420 IF A=0 THEN PRINT "DATA NOT FOUND"
480 PRINT : GOTO 90
570-720 Data statements to be searched
900 PRINT N$: A=1
910 RETURN
```

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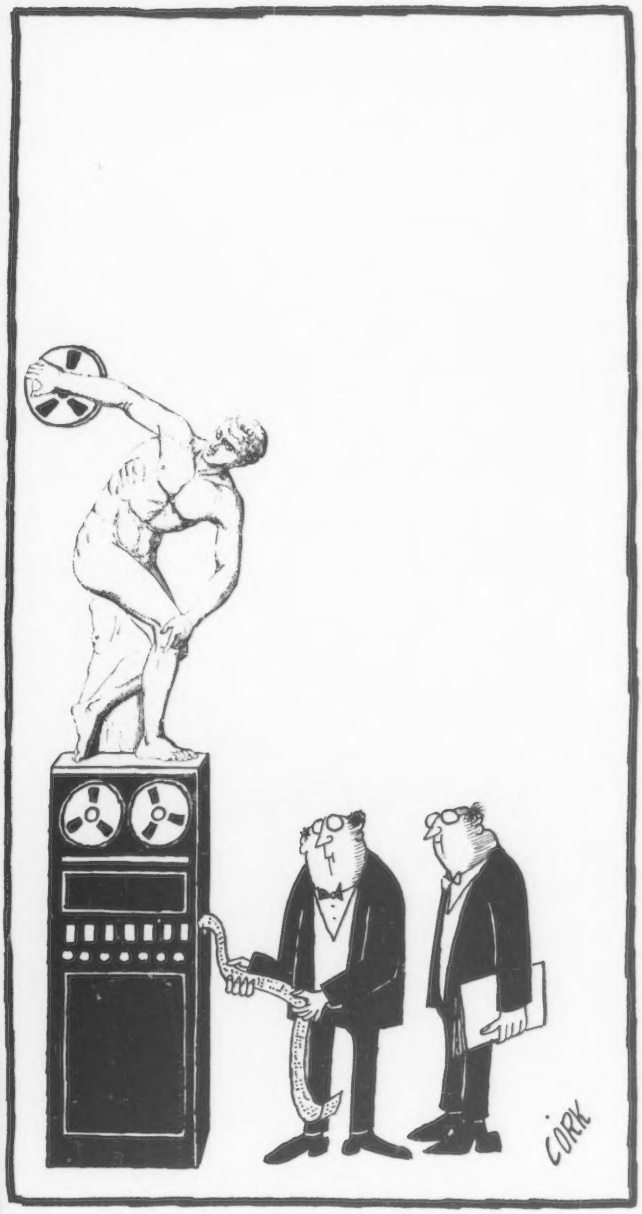

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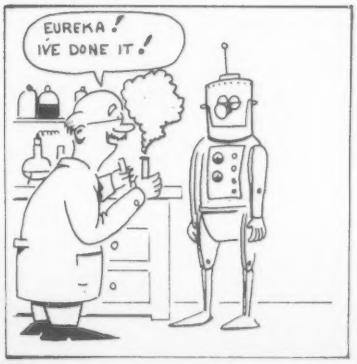

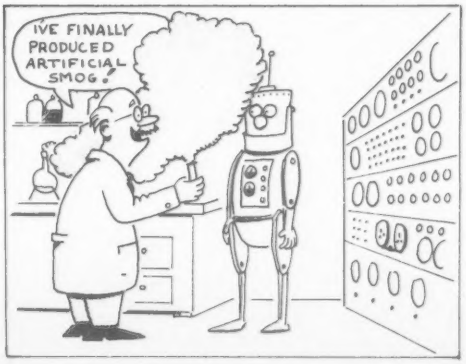

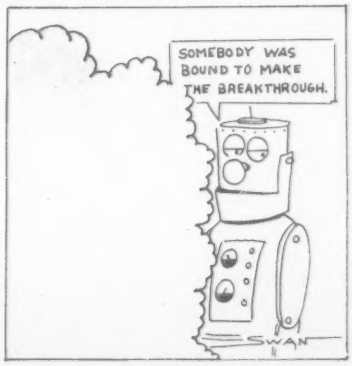

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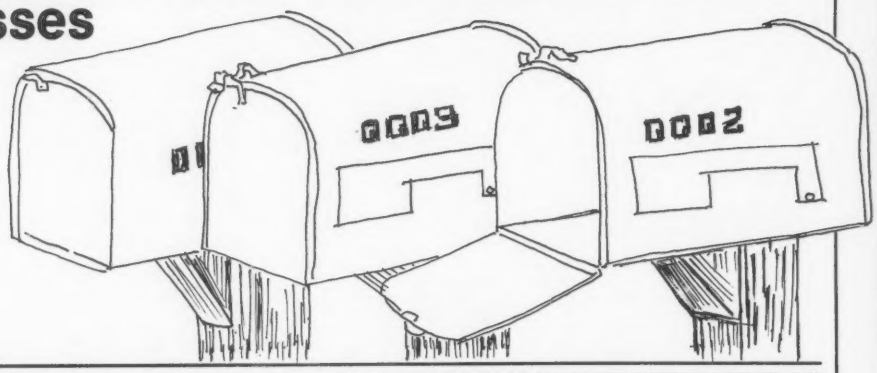

Donald M. Williams Sr.

MAILING LIST • LABELS • BILLINGS
Do it all with the SWTPC MF-68 Disk

This article outlines and explains a mailing list program, complete with update, label printing and billings, all in one package. It is presented here and released from copyright for hobby or home use only. Williams Data-Comp Division reserves the rights to all commercial or business applications, in whole or part.

In portions of the program it should be noted that some of the branches could be either GOTO or GOSUB. They were changed to demonstrate (to the less experienced programmer) that either will do the job. It should be remembered that in most stances, the accepted procedure would be the use of GOSUB. This is followed in the listing shown, except where recoded for this article.

System Requirements

Mailing list is written for SWTPC Basic Bk (C), Flex disk version. This version of BASIC and DOS is adequate for many business applications, with the exception that there are no PRINT USING, IMAGE, or logical statements supported. This difficulty is worked around, as demonstrated in the program. The most restricting feature of Mini-Flex is the lack of random data files which were not included for space conservation on the disk. While it would have been much simpler and faster to have random data files available, the sequential data file scheme is adequate, but somewhat slower. It would be advisable to those considering the purchase of a disk unit for the SWTPC System, to carefully consider the major use. For primarily business applications the larger, double sided SWTPC disk (DMAF1) would be a better choice (at twice the cost). If occasional business and mostly hobby or home applications are the norm, then the smaller (MF-68) will do nicely. Either one gets the job done.

Mailing List, even though written in BASIC, does a satisfactory job for small to medium applications (1 to 2000) items. It has features not found in other packages, such as a Menu that is interactive continually, with all functions returning to the Menu. Listings such as name, address (street and number), city, state and zip code (with key-mix) may be deleted or updated individually. Two printers are supported in this version. Simple changes can vector all printer I/O to one printer. The routines are shown both ways to enable easy nodification to the program. This version also supports two printer functions. The printer at port #7 prints only labels (Avery #5356, roll address labels). The printer at port #0 is used in the PRNOT routine. This routine is unique to this program. PRNOT is called at the end of the program. It then edits the entire data file and automatically prepares expiration notices, for expiring and expired subscriptions. These are completely formatted to include all necessary information, including a letterhead, indicators for seperation of notices and spacing so that folding on the first dotted line enables them ready for insertion into window envelopes. We have applications where the choice of printers varies from the more expensive to ASR-33's and SWTPC PR-40's. It should be a fairly simple matter to tailor this program to practically any version of BASIC and disk system now available.

US Postal "Service" Considerations

One major requirement for any mailing list program is the need to conform to U.S. Postal Regulations. This program is currently being used by a small legal and business newspaper. They mail over ninety percent of the total press run. Therefore, the handling of mailing labels is of prime consideration and very important to the development of computer programs to create the mailing list and labels. The more important regulations need to be examined first, this will explain why the generation of mailing labels could get sticky.

The post office requires mailers of material such as newspapers (2d Class) to prepare the mail bundles in a certain manner. The bundles of papers, if 10 or more per zip code, must be sorted by zip code, with a label for each bundle and zip code. If there are less than 10 papers going to a specific zip code, then they must be labeled and bundled with other mixed zip code bundles. In **Mailing List** the individual zip codes are easily handled. The problem gets somewhat more difficult when the computer must determine which go to specific zip codes and which are sent in mixed zip code bundles. The method to determine the mixed bundles and prepare the proper label is handled by 'key-mix', to be explained later in the article.

Whenever volume mailings are anticipated and the labels and list are to be computer-generated, the computer should be required to accomplish the assignment. Zip codes are easily handled until we come to the point

where we have mixed zip code bundles. When this occurs normal table searches by the computer become more complex. Lines 6252 — 6255 simplify this chore. In this article only four mixed zip code designations are used (key-mix), any additional amount could be added, using the same method as shown here. For larger mailings a counter type routine would be more efficient. However, where the operation is small this method works quite well.

Program Description and Operation

For the remainder of this article the following designations will be used. First, the entire data file, **Mailing List,** will be referenced as the file. Second, the file consists of the individual subscriptions, which will be designated as records. Third, the records consist of 7 fields (N$, A$, P$, V$, D, M, Y). N$ is the name field. A$ is the street and number field. P$ is the city, state field. V$ is the zip code, with key-mix coding field. D, M, Y is the subscription expiration data field. The file has also a current date record, this consist of 3 fields, (D1, M1, Y1). Anytime we read the file, care must be exercised to insure that the date record (3 files) is read first. Otherwise the computer would read the 3 date fields as the first 3 record fields. Don't forget that when writing to disk, the 3 date fields, should be considered, as when reading a disk record.

Each mixed zip code is enter into the data file, at initial entry, followed by two spaces and the special code (37400 M4), this tells the computer (line 6251 — 6255) that this will go to a mixed label list and is not to be included with other 374 — zip codes, (M4) being the key-mix code. If the label is to go into a regular zip code bundle then no key-mix code or spaces are assigned, at initial entry. This method allows the printing of labels in sequence by zip code, starting at the lowest numbers and progressing to the highest. Each separate zip code has a bundle label printed first and then the remainder of the labels for that particular zip code. This continues until the mixed zip codes (Mixed 374, Mixed states, Mixed Tn., etc.) are processed. In the routines used here the data records are repeatedly accessed until all zip codes have been processed in groups, and with bundle labels that allow bundle processing in an orderly manner. The final label printed has two notations, the End of File statement and the date of processing. this precludes the chance of mailing with an incomplete list or one out of date.

The program uses two data files, as shown in lines 10-25. File #1, Li.Dat, is always maintained as the primary data file. File #2, Temp.Scr, is created each time we call the program. The data file Temp.Scr receives the data read from data file Li.Dat if no match is found. If a match is found, in a read and write loop, the new variables are assigned from inputs and the next write command then passes to disk the newly assigned variables, thereby updating the records, to Temp.Scr (lines 8000 — 8250). At final closing the file Temp.Scr is converted to the primary data file Li.Dat and the old Li.Dat is killed (line 1810). Kill is a disk command supported by this version of BASIC. Those versions not supporting this command may accomplish the same end results in DOS or other commands used by other disk BASICs.

At line 40 the date is entered, this keeps the posting record current. Line 41 requires a password. The input statement at line 42 should be changed to whatever is desired. This inhibits access to the file by unauthorized persons.

Lines 103 — 116 format the Menu and are written to the CRT after each function, except close, which calls a master menu containing this program and an inventory program.

Lines 230 — 270 read file #1, Li.Dat, and if a match is found fall thru to the routine that prints to the CRT the complete record for that request: (C$) if C$ is a name. If the name is not found, then at the end of file read (line 260) the routine jumps to line 1400, there notification is made that the name is not in file and the option is given (line 1420-1430) to add to the file. At line 1440 if no new entry is desired the program returns to line 100 where file #1, Li.Dat, is restored to the beginning and the Menu repeated.

The commands Names, City-State, Zip Code, List and Date are read-only commands. In each instance they start at the top of file #1 and read to the end, then file #1 is restored to the top. The command called has, in the meantime, been prin ted to the CRT.

One feature foun d in flex is a Pause function. Pause is functional in BASIC. It allows the system to be programmed to page size, including depth of page (number of lines) and width of page (number of columns). Other features are available, but pause is affected by the depth of page portion. If the CRT terminal is a 16 line terminal, as any record is written to the CRT, the program allows the screen to fill (all 16 lines), it then pauses and will pass no more to the terminal until escape is typed. Sixteen more lines are then printed. By this function terminal displays do not over-run the CRT line limit. If system adaptation is necessary due to the absence of pause in your system, the program could be modified with a For-Next loop, allowing a sufficient amount of time to permit editing of the material printed to the CRT.

The command Change File allows deletion of the entire record, or changes to any or all segments of the record. Change first searches the data file (#1) for the name specified in line 1500. It then prints to the CRT the entire record, thus allowing an edit of the record, prior to any deletion or modification. Should a name, not resident in the data file, be called, it allows the insertion of a new record. Records are then edited, item by item, until the file is current. The program returns to Menu for additional modification or closing. Lines 8000 — 8250 prompt and input for changes.

The command PRLI prints the mailing labels on the printer at port #7. This routine starts at line 6020. Some explanation is probably needed here. The reason we started at line 6020 is because in this particular application (mazagine article) we use a dummy subscription list. In the listing it should be noted that we are not using a real mail list and none of the examples use the zip codes prior to zip code #37420. (note line 160). In your application the table from lines 6000 — 6173 should be changed to the zip codes on your mailing list.

Starting at line 6300 we commence the actual reading of the data file for key-mix coding. When a match is not found, line 6320 (Q$ <> RIGHT$ (V$,2), we go to line 6300 and read more of the data file (bypassing) any known key-mix zip codes. If a match is found (key-mix), we fall thru to a GOTO, which vectors the program to the printer routine.

Line 6251 prints the bundle label, this has only the zip code designated by the key-mix, printed in the center of the label. Lines 6252 — 6255 are the table for key-mix or non standard zip codes. At line 7004 we read the data file from the top and continue reading the file until the required zip code is found, then falling thru to line 7010 where we format and print the label.

Note should be made that in this version of Basic we could also call a port I/O by the Basic statement Port=X where X is the port number (note lines 9001 — 9004). If a Port= statement is used by your modification of this program, remember to always give a port command that returns to the control port (port #1 for SWTPC

BASIC 8K). The printing of the actual mailing label starts at line 7010 and continues thru line 7060.

The command PRNOT is a convenient routine for preparing expiration notices after each label printing. When called, the program jumps to line 9000. Here the files are prepared for a search of the entire data field (#1) and allow the option of editing the notices on the CRT, or sending them direct to the printer (lines 9001 — 9004) for final processing. Here the Port= variable is being assigned by operator choice (Z1).

Lines 9030 — 9040 determine if the subscription has expired. If not the program falls thru to a call back to the control port and searches the next record for expired dates. Also at these lines we have worked around not having the logical AND function available. At line 9105 the variable Z1 is assigned by lines 9020 and 9030, thus calling for either CRT Display or printer processing. The dotted line printed at line 9200 allows folding of the notice to fit a standard window envelope. The dashes ordered by line 9110 are printed to give a visual mark where the notices are to be cut to page size. Three dases spaced across the page top and bottom help when roll type paper is being used.

Summary

It should be apparent now, that b y the mere changing of string variables, numeric variables and formatting, this could be an inventory, work and materials records program, or used in other ways.

Mailing List, as presented here, while performing as well, is not coded as our commercial and business version. The differences being that numerous changes were made, in an attempt to demonstrate how some of the functions and routines could be changed. For simplicity, the original runs are combined here in three parts. I hope that by chopping and changing, I have been able to help some less experienced programmers, understand some of the basic features of the disk system. As noted earlier, there are better ways of coding. By recoding as suggested previously, the practice may shed some light, on disk programming, to those new to computers and disk systems. ■

BASIC Listing. (Note: Line 6170 needs REM statement added to comment.)

```
0010 REM ** MAILING LIST PROGRAM, WORKS WITH TWO FILES LI.DAT, AND
0020 REM USES A  TEMPORARY FILE ON THE WORKING DRIVE BY THE NAME
0025 REM "TEMP.SCR"
0030 LINE= 90
0035 PRINT CHR$(26)
0040 PRINT "DATE  (DD MM YY)"
0041 INPUT "AS -> 23 04 78 ",D1,M1,Y1
0042 PRINT :INPUT"PASSWORD, PLEASE: ",Q$
0044 IF Q$ <> "PASSWORD" GOTO 42
0048 PRINT CHR$(26)
0050 OPEN #2, TEMP.SCR
0085 OPEN #1, LI.DAT
0090 REM MENU OF OPERATION
0100 REM **  LOOP TO PROCESS  EACH LOOKUP   **
0102 RESTORE #1
0103 PRINT "* TO DISPLAY---------TYPE"
0104 PRINT "----------------------------"
0105 PRINT " NAMES                 -"
0106 PRINT " CITY - STATE          ="
0107 PRINT " ZIP CODE              :"
0108 PRINT " CHANGE FILE           /"
0109 PRINT " NEW FILE ENTRY        ;"
0110 PRINT " EXIT PROGRAM       CLOSE"
0111 PRINT " PRINT MAIL LIST    PRLI"
0112 PRINT " SCREEN DISPLAY     LIST"
0113 PRINT " EXPIRATION DATE    DATE"
0114 PRINT " EXPIRATION NOTICE  PRNOT"
0115 PRINT "----------------------------"
0116 INPUT "COMMAND OR NAME DESIRED: ";C$
0118 PRINT
0119 IF C$="PRNOT" GOTO 9000
0120 IF C$="CLOSE" THEN CLOSE #1,#2: GOTO 9999
0122 IF C$="/" GOTO 1500
0125 IF C$=";" GOTO 1610
0130 IF C$="-" GOTO 3000
0140 IF C$=":" GOTO 4000
0150 IF C$="=" GOTO 5000
0160 IF C$="PRLI" GOTO 6020                    : REM CHANGE AS ZIPS ADDED
0170 IF C$="LIST" GOTO 2000
0180 IF C$="" GOTO 100
0190 IF C$="DATE" GOTO 5050
0200 REM ** HERE TO SEARCH FILE FOR NAME
0230 RESTORE #1
0250 READ #1,N$,A$,P$,V$,D,M,Y
0260 IF EOF(1) <> 0 GOTO 1400
0270 IF N$ <> C$ GOTO 250
1000 REM HERE IF ENTRY IS FOUND
1030 PRINT "NAME:"; TAB(25); N$
1032 PRINT "ADDRESS:"; TAB(25); A$
1035 PRINT "CITY, STATE, ZIP:";TAB(25);P$;"  ";V$
1040 PRINT "EXP. DATE:";TAB(25);D;M;Y:PRINT
1050 GOTO 100
1400 REM ** HERE IF ENTRY NOT FOUND
1410 PRINT :PRINT"-<- CAN NOT FIND  ";C$; "<-"
1420 PRINT "SHALL WE ADD TO THE FILE (Y/N) ";CHR$(07);
1430 INPUT C$
1435 IF C$"/" GOTO 1500
1440 IF ASC(C$) <> ASC("Y") GOTO 100
1445 IF C$="" GOTO 100
1450 GOTO 1515
1500 PRINT CHR$(26):INPUT"  WHO SHALL WE CHANGE",C$:X$=C$
1505 IF C$="" GOTO 100
1515 SCRATCH #2
1520 RESTORE #1                              : REM REWIND
1530 READ #1,N$,A$,P$,V$,D,M,Y
1535 IF N$=X$ GOTO 1860
1540 IF EOF(1)=1 GOTO 1860
1545 WRITE #2,N$,A$,P$,V$,D,M,Y
1550 GOTO 1530
1600 REM HERE WE PLACE NEW SUBSCRIBERS TO THE DISK FILE
1610 PRINT :PRINT"NOTE!..DO NOT USE COMMAS (,)!"
1615 PRINT "  -TYPE 'RETURN' TO EXIT-"
1650 PRINT
1700 INPUT "NAME", N$
1710 IF N$="" GOTO 2000
1720 INPUT "ADDRESS", A$
1730 INPUT "CITY, STATE:",P$
1733 INPUT "ZIP CODE:",V$
1735 INPUT "EXP. DATE:",D,M,Y
1740 WRITE #2,N$,A$,P$,V$,D,M,Y
1790 GOTO 1650
1800 REM DELETE ORIG. FILE LEAVE NEW ONE
1810 CLOSE #1,#2: KILL LI.DAT:RENAME TEMP.SCR LI.DAT:OPEN #2,TEMP.SCR
1820 GOTO 85
1860 PRINT :PRINT"THIS IS AS IN FILE, PLEASE CHANGE LINE BY LINE:"
1865 PRINT
1870 PRINT "NAME:";TAB(20);N$:PRINT"ADDRESS:";TAB(20);A$
1880 PRINT "CITY, STATE, ZIP:";TAB(20);P$;"  ";V$;"  ";D;M;Y
1885 PRINT
1890 X$=N$
1895 PRINT "* NOTE!..ONCE DELETED, GONE FOREVER! *"
1900 INPUT "DELETE THE WHOLE LISTING (Y/N) ",K$
1910 IF K$="Y" GOTO 2000
1920 PRINT :GOTO 8000
2000 READ #1,N$,A$,P$,V$,D,M,Y
2010 IF EOF(1)=1 THEN PRINT:PRINT"END OF FILE!": GOTO 1800
2015 IF C$="LIST" GOTO 8800
2020 WRITE #2,N$,A$,P$,V$,D,M,Y
2030 GOTO 2000
3000 PRINT
3005 READ #1,N$,A$,P$,V$,D,M,Y
3010 IF EOF(1)=1 THEN PRINT"END OF FILE!":PRINT:RESTORE #1: GOTO 90
3015 PRINT N$;"  ";A$
3018 PRINT P$;"  ";V$;"      ";D;M;Y
3020 PRINT : GOTO 3005
4000 PRINT
4005 READ #1,N$,A$,P$,V$,D,M,Y:PRINT V$;
4006 PRINT CHR$(10);CHR$(13)
4010 IF EOF(1)=1 RESTORE #1: GOTO 90
4020 GOTO 4005
5000 READ #1,N$,A$,P$,V$,D,M,Y: PRINT P$;"   ";V$
5010 IF EOF(1)=1 RESTORE #1: GOTO 90
5020 GOTO 5000
5050 READ #1,N$,A$,P$,V$,D,M,Y
5060 IF EOF(1)=1 RESTORE #1:PRINT: GOTO 90
5065 PRINT D;M;Y
5070 GOTO 5050
6000 A=37400: GOSUB 7000       :REM BEGINNING ZIP CODE TABLE
6001 A=37401: GOSUB 7000
6002 A=37402: GOSUB 7000
6003 A=37403: GOSUB 7000
6004 A=37404: GOSUB 7000
6005 A=37405: GOSUB 7000
6006 A=37406: GOSUB 7000
6007 A=37407: GOSUB 7000
6008 A=37408: GOSUB 7000
6009 A=37409: GOSUB 7000
6010 A=37410: GOSUB 7000
6011 A=37411: GOSUB 7000
6012 A=37412: GOSUB 7000
6013 A=37413: GOSUB 7000
6014 A=37414: GOSUB 7000
6015 A=37415: GOSUB 7000
6016 A=37416: GOSUB 7000
6017 A=37417: GOSUB 7000
6018 A=37418: GOSUB 7000
6019 A=37419: GOSUB 7000
6020 A=37420: GOSUB 7000
6021 A=37421: GOSUB 7000
6050 A=37450: GOSUB 7000
6100 A=37343: GOSUB 7000
6110 A= 0
6170 Q$="M0": GOSUB 6300       BEGINNING OF MIXED ZIP TABLE
6171 Q$="MT": GOSUB 6300
6172 Q$="M3": GOSUB 6300
6173 Q$="M4": GOSUB 6300
6190 Q$="0"
6200 PRINT #7:PRINT #7:PRINT #7,"END OF LIST!";"        ";D1;M1;Y1
6210 GOTO 90
6250 PRINT #7
6251 IF A<>0 PRINT#7,"      ";A
6252 IF Q$="M3" PRINT#7,"         MIXED 373"
6253 IF Q$="M4" PRINT#7,"         MIXED 374"
6254 IF Q$="MT" PRINT#7,"         MIXED TENN."
6255 IF Q$="MS" PRINT#7,"         MIXED STATES"
6260 FOR X=1TO4:PRINT#7:NEXTX:RESTORE#1:IF A=0 GOTO 6350
```

```
6270 GOTO 7004
6300 READ #1,N$,A$,P$,V$,D,M,Y
6310 IF EOF(1)=1 THEN RESTORE #1: RETURN
6320 IF Q$<>RIGHT$(V$,2) GOTO 6300
6340 GOTO 6250
6350 READ #1,N$,A$,P$,V$,D,M,Y
6360 IF EOF(1)=1 RESTORE #1: RETURN
6370 IF Q$ <> RIGHT$(V$,2) GOTO 6350
6380 PRINT #7,N$
6390 PRINT #7,A$
6400 PRINT #7,P$;"   ";V$;"   ";D;M;Y
6410 PRINT #7:PRINT#7:PRINT#7
6420 GOTO 6350
6500 READ #1,N$,A$,P$,V$,D,M,Y
6510 IF EOF(1)=1 THEN RESTORE #1: RETURN
6530 IF V$=STR$(A) GOTO 6250
7000 GOTO 6500
7004 READ #1,N$,A$,P$,V$,D,M,Y
7005 IF EOF(1)=1 RESTORE #1: RETURN
7008 IF STR$(A) <> V$ GOTO 7004
7010 PRINT #7,N$
7020 PRINT #7,A$
7030 PRINT #7,P$;"  ";V$;"   ";D;M;Y
7033 PRINT #7
7035 PRINT #7
7050 PRINT #7
7060 GOTO 7004
8000 INPUT "SHALL WE CHANGE NAME (Y/N) ",M$
8010 IF M$="Y" GOTO 8200
8020 INPUT "SHALL WE CHANGE ADDRESS (Y/N)",B$
8030 IF B$="Y" GOTO 8210
8040 INPUT "SHALL WE CHANGE CITY, STATE (Y/N)",Y$
8050 IF Y$="Y" GOTO 8220
8060 INPUT "SHALL WE CHANGE ZIP CODE (Y/N)",R$
8065 IF R$="Y" GOTO 8230
8070 INPUT "SHALL WE CHANGE EXP. DATE (Y/N)",G$
8080 IF G$="Y" GOTO 8240
8090 GOTO 2020
8200 INPUT "NAME CHANGES ",N$: GOTO 8020
8210 INPUT "ADDRESS CHANGES ",A$: GOTO 8040
8220 INPUT "CITY, STATE CHANGES ",P$
8225 GOTO 8060
8230 INPUT "ZIP CODE CHANGE ",V$
8235 GOTO 8070
8240 INPUT "NEW EXP. DATE (DD MM YY) ",D,M,Y
8245 PRINT
8250 GOTO 2020
8800 PRINT :PRINT:PRINT:PRINT: PRINT"-------------------------"
8805 PRINT N$
8810 PRINT A$
8815 PRINT P$;"   ";V$;"   ";D;M;Y
8820 PRINT "-------------------------------------- "
8825 PRINT "-END TYPE 'EXIT'"
8827 PRINT "* NOTE!..ONCE DELETED, GONE FOREVER! *"
8830 INPUT "DELETE THIS ONE (Y/N) ",L$
8832 IF L$="EXIT" THEN C$="0":GOTO 2020
8835 PRINT
8840 IF L$="Y" GOTO 2000
8850 GOTO 2020
9000 SCRATCH #2: RESTORE #1
9001 PRINT :INPUT"TO PRINTER OR SCREEN (P/S): ",D$:PORT=1
9002 IF Q$="P" THEN Z1=0
9004 IF Q$="S" THEN Z1=1
9010 READ #1,N$,A$,P$,V$,D,M,Y
9020 IF EOF(1)=1 GOTO 1800
9030 IF M<M1 THEN IF Y<=Y1 GOSUB 9105
9040 IF M>M1 THEN IF Y<Y1 GOSUB 9105
9050 PORT= 1
9060 WRITE #2,N$,A$,P$,V$,D,M,Y
9080 GOTO 9010
9105 PORT= Z1
9108 PRINT :PRINT:PRINT
9110 PRINT :PRINTTAB(10);"-";TAB(35);"-";TAB(60);"-":PRINT:PRINT
9120 PRINT "                    HAMILTON COUNTY HERALD"
9130 PRINT "                      6131 AIRWAYS BLVD."
9140 PRINT "                    CHATTANOOGA, TN. 37421"
9150 PRINT :PRINT"                                    TELEPHONE 615/892-7544"
9153 PRINT TAB(60);D1;M1;Y1
9155 PRINT :PRINT:PRINT:PRINT
9160 PRINT :PRINT TAB(5);N$
9170 PRINT TAB(5);A$
9180 PRINT TAB(5);P$;"    ";V$
9185 PRINT :PRINT
9190 PRINT TAB(25);"PLEASE REMIT TO THE ADDRESS ABOVE - THANK YOU!"
9200 PRINT "-------------------------------------------------------------------";
9205 PRINT "-----------------"
9210 PRINT
9220 PRINT TAB(5);"EXPIRATION DATE: ";D;M;Y
9230 PRINT :PRINT TAB(40);"SUBSCRIPTION RATE - 1 YEAR  $14.50"
9240 PRINT TAB (40);      "                    2 YEARS $27.50"
9250 PRINT TAB(40);       "                    3 YEARS $36.50"
9270 PRINT :PRINT "THANK YOU FOR YOUR PAST SUBSCRIPTION, PLEASE RENEW."
9280 PRINT "-------------------------------------------------------------------";
9285 PRINT "-----------------"
9290 PRINT "SERVING THE LEGAL, BUSINESS AND FINANCIAL COMMUNITY FOR OVER";
9291 PRINT " 65 YEARS!"
9300 PRINT :PRINT:PRINT:PRINT
9310 PRINT "                    SUPPORT THE '365  CLUB!":RETURN
9500 REM * COPYRIGHTED 1978
9510 REM * BY DATA-COMP DIV.
9520 REM * HIXSON, TN 37343
9999 CHAIN MENU
```


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CIRCLE 134 ON READER SERVICE CARD

One of the most popular uses of computers in small business is generating and maintaining mailing lists.

Mailing List System

Gary O. Young

If you are a small business, club, or organization, chances are a mailout is going to be needed at some point. A mailout is your cheapest and most effective way to advertise and keep people informed of coming sales, events, or meetings. Here is a simplified system to produce both mailing labels and name and address rosters.

FEATURES

The system consists of two BASIC programs. The first program creates and updates the data. The first item in the data file is the date the data was created or updated. This is used to verify that the correct file is being updated and printed. The actual name and address data is combined into one single variable length string for each person on the file to conserve space. The data occurs in alphabetical order based on last name, therefore updates must also be made in alphabetical order. The name should be entered as last name, comma, then first name. The first name will be rotated ahead of the last name on the printed labels. The name and street address can take more than one line simply by separating the lines with a "+". This is useful for "care of" or postal station names that require an extra line. Each person on the file is assigned a one character "type" code such as M-member, B-business, F-future prospect, etc. This code is used to select only certain people for labels or rosters. The zip code is essential because it may be used to sort the data by area for mailing before printing the labels.

The maximum file size on the North Star disk is 64K. If one label takes an average of 80 characters, only about 800 entries can be held in a single file. To overcome this limitation, input and output can span more than one file. When the file is opened, the size of the file is passed to the program thru the "OPEN" statement. When the end of the input file is reached, the program sill request the name of the next input file to continue the update. When the number of records written to the output file approaches the maximum (as determined by the size on the "OPEN"), the output file will be closed and the name of the next output file will be requested.

OPERATION

After requesting the input and output files, the program will prompt with a "?". The program then expects an action character followed immediately by the last name. The valid action characters are A-add, D-delete, C or R-change or replace, #-end of input. If there is no input file, enter only a carriage return. The program will create only the output file and prompt with "?A" to add each person. If there is no output file, enter only a carriage return. The input file will be printed unformatted for diagnostic purposes.

The name should be entered as last name, comma, first name, and optionally a "+" followed by the second line of the name. The type, street, city, state, and zip code will be requested for an add or change action. The type can be any single letter or number as stated earlier. The street is not edited and may contain a "+" to span more than one line. The state and zip code must be exactly seven characters: two for the state and the remaining five for the zip code (these must be numeric obviously). On a change action, if no data is entered when the type, street, city, state and zip code are requested, the old data will be retained. The spelling of the name cannot be changed since that might cause the file to get out of alphabetical order. Instead the name would have to be deleted and then added again in the proper location.

A maximum of 100 characters can be accepted per entry and the special characters "#", ">", "<, and "!", are reserved. When the end of the input file is reached, the next input file will be requested. Enter the next input file name or a carriage return to signal the end of input. When the output file is full, an additional output file name will be requested.

SELECT AND PRINT PROGRAM

The second program will select certain data records according to the type and print labels or rosters. If all records are to be selected, just enter a carriage return. The program will then read the file, select the records, and build a table of the zip code and the character position of the record within the file. The maximum size of the table, and the number of records selected, will depend on the size of the memory. This table can be sorted on zip codes. Otherwise the data will be printed in alphabetical order. After selecting and sorting, the character position of the record within the file is used to do a random read of the record in the proper sequence. For this reason, only one file can be printed at a time even though multiple files can be updated. If a small number of records was selected from each file, an intermediate file could be created with the selected records from multiple files.

Either labels or a name and address roster can be printed. The roster is useful to list who is on the file for making additions or corrections in the next update. The name, last name first, is on one line and the rest of the address is on the next line for each entry

of the roster. The labels are printed one label across a page and the name is rotated.

AND FINALLY

These programs are written in North Star BASIC release 3. They require less than 32K of memory depending on the zip code table size. For those versions of BASIC that do not have the size parameter on the "OPEN" statement, the output file size might be an input parameter. The programs would be easy to convert to any disc BASIC, and fun to run as well as useful. ■

```
LOAD LABELGEN
READY
RUN



LABEL FILE UPDATE VERSION 2
INPUT FILE?
OUTPUT FILE? LABEL1
DATE (YYMMDD)? 780501
?AACME HARDWARE STORE
TYPE? S
STRT? 35 MAIN ST
CITY? MAR VISTA
STZIP? CA91111

?AALLEN,JOE
TYPE? P
STRT? PO BOX 333+HAMPTON STATION
CITY? SAN DIEGO
STZIP? CA91112

?ABROWN,CHARLIE+SNOOPY
TYPE? P
STRT? COMIC STRIP DR
CITY? HOLLYWIERD
STZIP? BAD ZIP CODE
STZIP? CA90066

?ADOE,JOHN
TYPE? P
STRT? MAIN ST USA
CITY? ANYTOWN
STZIP? AZ00000

?AGOODTIMES SALOON+ATTN JOW BARTENDAR
TYPE? S
STRT? STAGGER ST+TONIC GULTCH
CITY? GIN VILLE
STZIP? VA12345

?A$-#
READY
RUN

LABEL FILE UPDATE VERSION 2
INPUT FILE? LABEL1
OUTPUT FILE?
CREATED:  780501
SACME HARDWARE STORE>35 MAIN ST<MAR VISTA+CA91111
PALLEN,JOE>PO BOX 333+HAMPTON STATION<SAN DIEGO+CA91112
PBROWN,CHARLIE+SNOOPY>COMIC STRIP DR<HOLLYWI"RD+CA90066
PDOE,JOHN>MAIN ST USA<ANYTOWN+AZ00000
SGOODTIMES SALOON+ATTN JOW BARTENDAR>STAGGER ST+TONIC GULTCH<GIN VILLE+V
A12345
INPUT FILE FINISHED
NEW INPUT FILE?
READY

RUN

LABEL FILE UPDATE VERSION 2
INPUT FILE? LABEL1
OUTPUT FILE? LABEL2
DATE (YYMMDD)? 780502
OLD DATE? 780501

?AABLE HANDS GLOVE CO
TYPE? S
STRT? 111 GLOVE LN
CITY? DETROIT
STZIP? MI55555

?DALLEN
DELETED

?CGOODTIMES
TYPE?
STRT?
CITY? RICHMOND
STZIP?

?AYOUNG,G
INPUT FILE FINISHED
NEW INPUT FILE?
TYPE? P
STRT? STATE ST
CITY? LOS ANGELES
STZIP? CA90066
```


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DECwriter III, RO	2,095	200	107	73
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VT100 CRT DECscope	1,595	153	81	56
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TI 765 Bubble Mem.	2,995	285	152	99
TI 810 RO Printer	1,895	181	97	66
TI 820 KSR Terminal	2,395	229	122	84
QUME, Ltr. Qual. KSR	3,195	306	163	112
QUME, Ltr. Qual. RO	2,795	268	143	98
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HAZELTINE 1500 CRT	1,195	115	67	42
HAZELTINE 1520 CRT	1,595	153	81	56
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CIRCLE 168 ON READER SERVICE CARD

Sample label run (PRLI). Spaced for noted labels.

```
     37421



JOE BLOW
3333 STREET
CHATT TN  37421   2 4 77


WILLIAMS CO INC
6129 AIRWAYS BLVD
CHATTANOOGA TN  37421   3 15 79


HAMILTON COUNTY HERALD
6131 AIRWAYS BLVD.
CHATTANOOGA TN  37421   13 12 81


       MIXED 373


DATA-COMP DIV
3018 HAMILL RD
HIXSON TN   37343  M3   3 8 77


JOYCE WILLIAMS
3018 HAMILL RD.
HIXSON TN   37343  M3   10 12 83


       MIXED 374


D. M. WILLIAMS
0000 ANY STREET
EAST RIDGE TN   37421  M4   11 1 77


HAROLD WILLIAMS
OOLTEWAH-RINGGOLD ROAD
OOLTEWAH TN   37411  M4   12 12 80



END OF LIST!       6 6 78
```

Sample run of PRNOT expired notices.

```
HAMILTON COUNTY HERALD
  6131 AIRWAYS BLVD.
CHATTANOOGA, TN. 37421

        TELEPHONE 615/892-7544
                                    6 6 78


JOE BLOW
3333 STREET
CHATT TN    37421

                    PLEASE REMIT TO THE ADDRESS ABOVE - THANK YOU!
-------------------------------------------------------------------------

   EXPIRATION DATE: 2 4 77

                                SUBSCRIPTION RATE - 1 YEAR  $14.50
                                                    2 YEARS $27.50
                                                    3 YEARS $36.50

THANK YOU FOR YOUR PAST SUBSCRIPTION, PLEASE RENEW.
-------------------------------------------------------------------------
SERVING THE LEGAL, BUSINESS AND FINANCIAL COMMUNITY FOR OVER 65 YEARS!


                    SUPPORT THE '365' CLUB!

-                   -                   -


HAMILTON COUNTY HERALD
  6131 AIRWAYS BLVD.
CHATTANOOGA, TN. 37421

        TELEPHONE 615/892-7544
                                    6 6 78


D. M. WILLIAMS
3018 HAMILL RD.
HIXSON TN    37343

                    PLEASE REMIT TO THE ADDRESS ABOVE - THANK YOU!
-------------------------------------------------------------------------

   EXPIRATION DATE: 11 1 77

                                SUBSCRIPTION RATE - 1 YEAR  $14.50
                                                    2 YEARS $27.50
                                                    3 YEARS $36.50

THANK YOU FOR YOUR PAST SUBSCRIPTION, PLEASE RENEW.
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-                   -                   -


HAMILTON COUNTY HERALD
  6131 AIRWAYS BLVD.
CHATTANOOGA, TN. 37421

        TELEPHONE 615/892-7544
                                    6 6 78


DATA-COMP DIV
3018 HAMILL RD
HIXSON TN    37343  M3

                    PLEASE REMIT TO THE ADDRESS ABOVE - THANK YOU!
-------------------------------------------------------------------------

   EXPIRATION DATE: 3 8 77

                                SUBSCRIPTION RATE - 1 YEAR  $14.50
                                                    2 YEARS $27.50
                                                    3 YEARS $36.50

THANK YOU FOR YOUR PAST SUBSCRIPTION, PLEASE RENEW.
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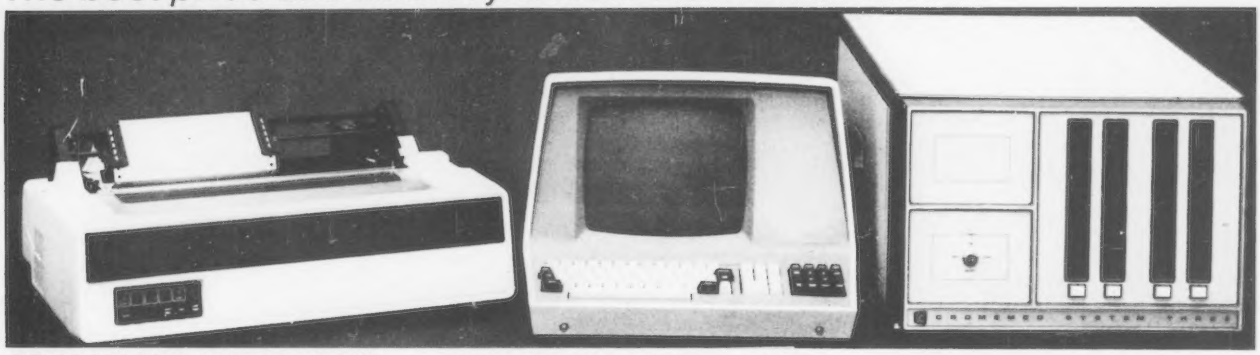

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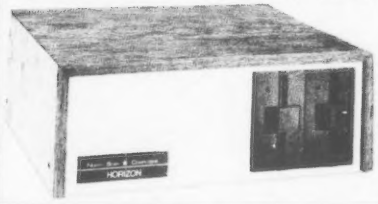

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TERMINALS

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North Star RAM-16-A 16K Dynamic RAM Board, **Kit**, (order 01-3216-0) List $399 . **329**
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CIRCLE 172 ON READER SERVICE CARD

```
?#
READY
RUN

LABEL FILE UPDATE VERSION 2
INPUT FILE? LABEL2
OUTPUT FILE?
CREATED:  780502
SABLE HANDS GLOVE CO>111 GLOVE LN<DETROIT!MI55555
SACME HARDWARE STORE>35 MAIN ST<MAR VISTA!CA91111
PBROWN,CHARLIE+SNOOPY>COMIC STRIP DR<HOLLYWIERD!CA90066
PDOE,JOHN>MAIN ST USA<ANYTOWN!AZ00000
SGOODTIMES SALOON+ATTN JOW BARTENDAR>STAGGER ST+TONIC GULTCH<RICHMOND!VA
12345
PYOUNG,G>STATE ST<LOS ANGELES!CA90066
INPUT FILE FINISHED
NEW INPUT FILE?
READY


LOAD LABELPRT
READY
RUN

LABEL SELECT AND PRINT VERSION 2
FILE? LABEL2
UPDATED:  780502
SELECT CHARACTER OR (CR) FOR ALL P
SORT BY ZIP (Y OR N)? Y
ROSTER (R) OR LABELS (L)? L
SELECTED  3 RECORDS
SET PAPER AND RETURN


COMPARES: 5  SWAPS: 1


JOHN DOE
MAIN ST USA
ANYTOWN, AZ 00000




CHARLIE BROWN
SNOOPY
COMIC STRIP DR
HOLLYWIERD, CA 90066




G YOUNG
STATE ST
LOS ANGELES, CA 90066




READY
RUN

LABEL SELECT AND PRINT VERSION 2
FILE? LABEL2
UPDATED:  780502
SELECT CHARACTER OR (CR) FOR ALL
SORT BY ZIP (Y OR N)? N
ROSTER (R) OR LABELS (L)? R
SELECTED  6 RECORDS
SET PAPER AND RETURN
ROSTER UPDATED: 780502   FILE: LABEL2   SELECTED TYPE: ALL


ABLE HANDS GLOVE CO
111 GLOVE LN,   DETROIT, MI 55555


ACME HARDWARE STORE
35 MAIN ST,   MAR VISTA, CA 91111


BROWN,CHARLIE (+) SNOOPY
COMIC STRIP DR,   HOLLYWIERD, CA 90066


DOE,JOHN
MAIN ST USA,   ANYTOWN, AZ 00000


GOODTIMES SALOON (+) ATTN JOW BARTENDAR
STAGGER ST (+) TONIC GULTCH,   RICHMOND, VA 12345


YOUNG,G
STATE ST,   LOS ANGELES, CA 90066



1000 PRINT "LABEL FILE UPDATE VERSION 2"
1100 REM WRITTEN BY GARY YOUNG
1200 REM              PO BOX 66572
1300 REM              LOS ANGELES, CA 90066
1400 REM NORTH STAR BASIC REL 3
1500 DIM B0$(105),B1$(105),B2$(105),L1$(105),L2$(105),L9$(105)
1600 INPUT "INPUT FILE? ",F1$
1700 IF LEN(F1$)=0 THEN S1=0 ELSE S1=1
1800 INPUT "OUTPUT FILE? ",F2$
1900 IF LEN(F2$)=0 THEN 23800
2000 INPUT "DATE (YYMMDD)? ",D1
2100 B1$="":\B2$=""
2200 IF S1=0 THEN 2500
2300 OPEN #1,F1$,S2
2400 O1=1
2500 OPEN #2,F2$,S3
2600 O2=1
2700 S5=5:\S6=(S3-1)*256
2800 WRITE #2,D1
2900 IF S1=0 THEN 4200
3000 IF S2>S3 THEN 3100 ELSE 3300
3100 PRINT "OUTPUT FILE TOO SMALL",S2,S3
3200 STOP
3300 READ #1,D2
3400 INPUT "OLD DATE? ",D3
3500 IF D2=D3 THEN 3800
3600 PRINT "DATES DO NOT MATCH ",D2,D3
3700 STOP
3800 PRINT
3900 IF S1=0 THEN 4200
4000 INPUT "?",L1$
4100 GOTO 4400
4200 INPUT "?A",L1$
4300 L1$="A"+L1$
4400 IF L1$(1,1)="#" THEN 9200
4500 IF LEN(L1$)<2 THEN 5100
4600 IF L1$(1,2)="A#" THEN 9200
4700 IF L1$(1,1)="A" THEN 5400
4800 IF L1$(1,1)="D" THEN 7300
4900 IF L1$(1,1)="C" THEN 8300
5000 IF L1$(1,1)="R" THEN 8300
5100 PRINT "INVALID ACTION...REENTER"
5200 GOTO 3800
5300 REM ADD ROUTINE
5400 IF S1=0 THEN 5800
5500 GOSUB 10500
5600 IF S4=0 OR S4=1 THEN 6100
5700 IF S4=99 THEN 3800 ELSE 6500
5800 IF B1$="" THEN 6100
5900 L=LEN(L1$)
6000 IF B1$(2,L)>L1$(2,L) THEN 7000
6100 GOSUB 14500
6200 B2$=B0$
6300 GOSUB 12900
6400 GOTO 3800
6500 GOSUB 14500
6600 B2$=B1$
6700 GOSUB 12900
6800 B2$=B0$:\B1$=B0$
6900 GOTO 3800
7000 GOSUB 12600
7100 GOTO 3800
7200 REM DELETE ROUTINE
7300 IF S1=0 THEN 5100
7400 GOSUB 10500
7500 IF S4<>0 THEN 8000
7600 GOSUB 17500
7700 IF U5>0 THEN B1$=""
7800 PRINT "DELETED"
7900 GOTO 3800
8000 PRINT "DELETED NAME NOT FOUND ",S4
8100 GOTO 3800
8200 REM REPLACE ROUTINE
8300 IF S1=0 THEN 5100
8400 GOSUB 10500
8500 IF S4<>0 THEN 8900
8600 GOSUB 19700
8700 B1$=B0$
8800 GOTO 3800
8900 PRINT "NAME NOT FOUND. CURRENT=",B1$(2,20)
9000 GOTO 3800
9100 REM COPY AND FINISH
9200 IF LEN(B1$)=0 THEN 9700
9300 B2$=B1$
9400 GOSUB 12900
9500 IF S1=0 THEN 10200
9600 IF O1=0 THEN 10200
9700 GOSUB 17500
9800 IF U5>0 THEN 10200
9900 B2$=B1$
10000 GOSUB 12900
10100 GOTO 9700
10200 IF O2=1 THEN CLOSE #2
10300 IF O1=1 THEN CLOSE #1
10400 END
10500 REM POSITION INPUT FILE
10600 S4=99
10700 IF S1=0 THEN RETURN
10800 IF B1$="" THEN GOSUB 17500
10900 L1=LEN(L1$)
11000 IF B1$(2,L1)>L1$(2,L1) THEN 12400
11100 IF B1$(2,L1)<L1$(2,L1) THEN 11500
11200 IF B1$(2,L1)>L1$(2,L1) THEN 12200
11300 S4=0
11400 RETURN
11500 B2$=B1$
11600 GOSUB 12900
11700 GOSUB 17500
11800 IF U5>0 THEN 12000
11900 GOTO 11100
12000 S4=-1
12300 RETURN
12400 IF B2$="" THEN 12200
12500 IF B2$(2,L1)<L1$(2,L1) THEN 12200
12600 PRINT "INPUT OUT OF SEQUENCE"
12700 PRINT B1$(1,L1)
12800 RETURN
12900 REM WRITE ROUTINE
13000 IF LEN(B2$)=0 THEN RETURN
13100 IF B2$=L9$ THEN RETURN
13200 L9$=B2$
13300 WRITE #2,B2$
13400 S5=S5+LEN(B2$)+2
13500 IF S5<S6 THEN RETURN
13600 PRINT "OUTPUT FILE FULL"
13700 CLOSE #2
```

```
13800 O2=0
13900 INPUT "NEW OUTPUT FILE? ",F2$
14000 OPEN #2,F2$,S3
14100 O2=1
14200 WRITE #2,D1
14300 S5=S\S6=(S3-1)*256
14400 RETURN
14500 REM INPUT REQUEST
14600 B0$=""
14700 INPUT "TYPE? ",L2$
14800 IF LEN(L2$)<>1 THEN 14700
14900 B0$=B0$+L2$(1,1)+L1$(2)+">"
15000 INPUT "STRT? ",L2$
15100 B0$=B0$+L2$+"<"
15200 INPUT "CITY? ",L2$
15300 B0$=B0$+L2$+";"
15400 GOSUB 15700
15500 B0$=B0$+L2$
15600 RETURN
15700 REM READ AND EDIT ZIP CODE
15800 INPUT "STZIP? ",L2$
15900 IF LEN(L2$)=7 THEN 16400
16000 IF LEN(L2$)<>0 THEN 15800
16100 IF L1$(1,1)="C" THEN RETURN
16200 IF L1$(1,1)<>"R" THEN 15800
16300 RETURN
16400 IF L2$(3,3)<"0" THEN 15800
16500 IF L2$(4,4)<"0" THEN 15800
16600 IF L2$(5,5)<"0" THEN 15800
16700 IF L2$(6,6)<"0" THEN 15800
16800 IF L2$(7,7)<"0" THEN 15800
16900 IF L2$(3,3)>"9" THEN 15800
17000 IF L2$(4,4)>"9" THEN 15800
17100 IF L2$(5,5)>"9" THEN 15800
17200 IF L2$(6,6)>"9" THEN 15800
17300 IF L2$(7,7)>"9" THEN 15800
17400 RETURN
17500 REM READ ROUTINE
17600 U5=0
17700 IF O1<>1 THEN 19200
17800 IF TYP(1)=0 THEN 18100
17900 READ #1,B1$
18000 RETURN
18100 CLOSE #1
18200 O1=0
18300 PRINT "INPUT FILE FINISHED"
18400 INPUT "NEW INPUT FILE? ",F1$
18500 IF LEN(F1$)=0 THEN 19200
18600 OPEN #1,F1$,S2
18700 O1=1
18800 READ #1,D2
18900 IF D2=D3 THEN RETURN
19000 PRINT "DATES DO NOT MATCH"
19100 STOP
19200 U5=99
19300 RETURN
19400 REM REPLACE ALL THE DATA EXCEPT THE NAME.
19500 REM IF NO NEW DATA WAS ENTERED,(STRING LENGTH ZERO),
19600 REM USE THE OLD DATA
19700 B0$=""
19800 INPUT "TYPE? ",L2$
19900 IF LEN(L2$)=1 THEN 20200
20000 IF LEN(L2$)<>0 THEN 19800
20100 B0$=B0$+B1$(1,1)\GOTO 20300
20200 B0$=B0$+L2$(1,1)
20300 FOR J=2 TO LEN(B1$)
20400 IF B1$(J,J)=">" THEN EXIT 20700
20500 B0$=B0$+B1$(J,J)
20600 NEXT
20700 B0$=B0$+">"
20800 INPUT "STRT? ",L2$
20900 IF LEN(L2$)>0 THEN 21600
21000 FOR K=J+1 TO LEN(B1$)
21100 IF B1$(K,K)="<" THEN EXIT 21400
21200 B0$=B0$+B1$(K,K)
21300 NEXT
21400 B0$=B0$+"<"
21500 GOTO 22000
21600 B0$=B0$+L2$+"<"
21700 FOR K=J+1 TO LEN(B1$)
21800 IF B1$(J,J)="<" THEN EXIT 22000
21900 NEXT
22000 INPUT "CITY? ",L2$
22100 IF LEN(L2$)>0 THEN 22800
22200 FOR J=K+1 TO LEN(B1$)
22300 IF B1$(J,J)=";" THEN EXIT 22600
22400 B0$=B0$+B1$(J,J)
22500 NEXT
22600 B0$=B0$+";"
22700 GOTO 23000
22800 FOR J=K+1 TO LEN(B1$)
22900 IF B1$(J,J)=";" THEN EXIT 23100
23000 NEXT
23100 B0$=B0$+L2$+";"
23200 GOSUB 15700
23300 IF LEN(L2$)=7 THEN 23600
23400 B0$=B0$+B1$(J+1)
23500 RETURN
23600 B0$=B0$+L2$
23700 RETURN
23800 REM PRINT ROUTINE
23900 OPEN #1,F1$
24000 O1=1
24100 READ #1,D
24200 PRINT "CREATED: ",D
24300 GOSUB 17500
24400 IF U5>0 THEN 24700
24500 PRINT B1$
24600 GOTO 24300
24700 CLOSE #1
24800 END
24900 REM THIS IS THE LAST STATEMENT
READY
```


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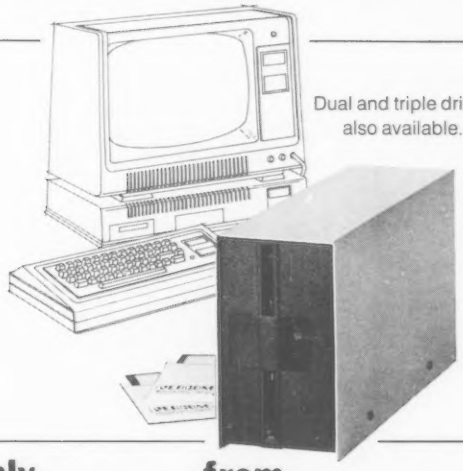

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CIRCLE 101 ON READER SERVICE CARD

```
1000 PRINT "LABEL SELECT AND PRINT VERSION 2"
1100 REM WRITTEN BY GARY YOUNG
1200 REM              PO BOX 66572
1300 REM              LOS ANGELES, CA 90066
1400 DIM F1$(8),R$(105),N$(30),Z(2,700)
1500 INPUT "FILE? ",F1$
1600 OPEN #1,F1$
1700 READ #1,D1
1800 PRINT "UPDATED: ",D1
1900 P=5
2000 INPUT "SELECT CHARACTER OR (CR) FOR ALL ",S$
2100 R1=0
2200 INPUT "SORT BY ZIP (Y OR N)? ",S1$
2300 IF S1$="Y" THEN 2500
2400 IF S1$<>"N" THEN 2200
2500 INPUT "ROSTER (R) OR LABELS (L)? ",S2$
2600 IF S2$="R" THEN 2800
2700 IF S2$<>"L" THEN 2500
2800 IF TYP(1)=0 THEN 4000
2900 READ #1,R$
3000 IF LEN(S$)=0 THEN 3400
3100 IF R$(1,1)=S$(1,1) THEN 3400
3200 P=P+LEN(R$)+2
3300 GOTO 2800
3400 R1=R1+1
3500 Z(1,R1)=P
3600 P=P+LEN(R$)+2
3700 L=LEN(R$)
3800 Z(2,R1)=VAL(R$(L-4,L))
3900 GOTO 2800
4000 PRINT "SELECTED ";R1;" RECORDS"
4100 INPUT "SET PAPER AND RETURN",G$
4200 IF S1$="N" THEN 6500
4300 REM SHELL METZNER SORT
4400 R2=R1
4500 R2=INT(R2/2)
   00 IF R2=0 THEN 6400
   00 R3=1
4800 R4=R1-R2
4900 R5=R3
5000 R6=R5+R2
5100 S8=S8+1
5200 IF Z(2,R5)<Z(2,R6) THEN 6100
5300 S8=S8+1
5400 IF Z(2,R5)=Z(2,R6) THEN 5800
5500 T9=Z(1,R5)\Z(1,R5)=Z(1,R6)\Z(1,R6)=T9
5600 T9=Z(2,R5)\Z(2,R5)=Z(2,R6)\Z(2,R6)=T9
5700 S9=S9+1
5800 R5=R5-R2
5900 IF R5<1 THEN 6100
6000 GOTO 5000
6100 R3=R3+1
6200 IF R3>R4 THEN 4500
6300 GOTO 4900
6400 PRINT "COMPARES:",S8,"  SWAPS:",S9
6500 IF S2$="L" THEN 6800
6600 PRINT "ROSTER UPDATED:",D1,"   FILE: ",F1$,"   SELECTED TYPE: ",
6700 IF S$="" THEN PRINT "ALL" ELSE PRINT S$
6800 FOR J1=1 TO R1
6900 P=Z(1,J1)
7000 READ #1%P,R$
7100 IF S2$="L" THEN GOSUB 7700 ELSE GOSUB 11400
7200 NEXT J1
7300 CLOSE #1
7400 PRINT\PRINT\PRINT
7500 END
7600 REM FORMAT ROUTINE
7700 L=2
7800 PRINT\PRINT
7900 K=1
8000 GOSUB 9700
8100 PRINT N$
8200 K=K+1
8300 IF R$(K,K)="+" THEN 8900
8400 IF R$(K,K)=">" THEN 8900
8500 IF R$(K,K)="<" THEN 8900
8600 IF R$(K,K)=":" THEN 9200
8700 PRINT R$(K,K),
8800 GOTO 8200
8900 PRINT
9000 L=L+1
9100 GOTO 8200
9200 PRINT ", ";R$(K+1,K+2);" ";R$(K+3,K+7)
9300 L=L+1
9400 IF L>7 THEN RETURN
9500 PRINT
9600 GOTO 9300
9700 REM ROTATE NAME AROUND THE COMMA
9800 C1=0\C2=0
9900 FOR J=2 TO LEN(R$)
10000 IF R$(J,J)<>"," THEN 10300
10100 C1=J
10200 GOTO 10800
10300 IF R$(J,J)="+" THEN 10600
10400 IF R$(J,J)=">" THEN 10600
10500 GOTO 10800
10600 C2=J-1\K=J
10700 EXIT 10900
10800 NEXT J
10900 IF C1=0 THEN 11200
11000 N$=R$(C1+1,C2)+" "+R$(2,C1-1)
11100 RETURN
11200 N$=R$(2,C2)
11300 RETURN
11400 REM ROSTER PRINT
11500 L=L+2
11600 PRINT\PRINT
11700 K=1
11800 K=K+1
11900 IF R$(K,K)="+" THEN 12500
12000 IF R$(K,K)=">" THEN 12700
12100 IF R$(K,K)="<" THEN 13000
12200 IF R$(K,K)=":" THEN 13200
12300 PRINT R$(K,K),
12400 GOTO 11800
12500 PRINT " (+) ",
12600 GOTO 11800
12700 PRINT
12800 L=L+1
12900 GOTO 11800
13000 PRINT ",   ",
13100 GOTO 11800
13200 PRINT ", ";R$(K+1,K+2);" ";R$(K+3,K+7)
13300 L=L+1
13400 RETURN
13500 REM THIS IS THE LAST STATEMENT
READY
```

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A basic mainframe with 8085 CPU board, Kit Order 21-5315-0 (List $799)

Cash Price $679

Assembled, (21-5415-0) List $995
Cash Price $805

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PCS-42 400 kilobaud disk storage
Order as 21-5442-0 (List $2995)
Cash Price $2545

PCS-44 780 kilobaud disk storage
Order 21-5444-0 (List $3695)
Cash Price $3139

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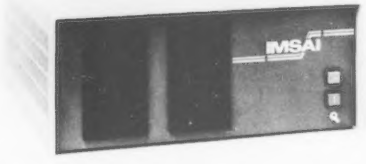

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Assembled, order 21-4504-0) (List $465) **$395**

SIO-2-1 Serial I/O, Kit, order as 21-3440-0 (List $125) **$110**

PIO/6-3 Parallel I/O, Kit, order as 21-3441-0 (List $139) **$125**

MIO Multiple I/O, Kit, order as 21-3442-0 (List $195) **$169**

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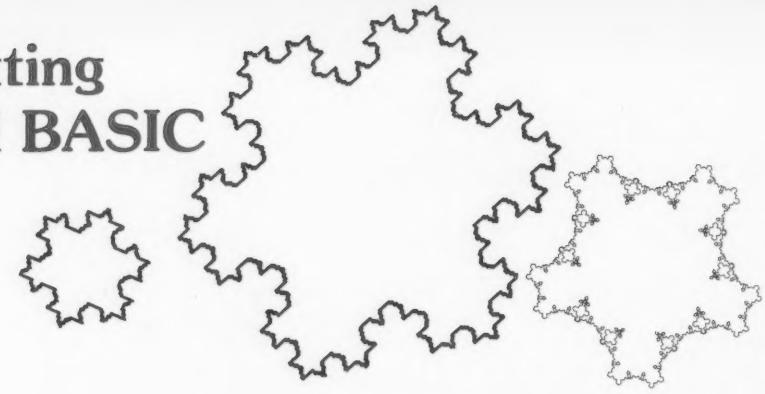
Snowflake Plotting in ALGOL and BASIC

James Jones



Introduction

The original snowflake curve (due to Helge van Koch) is strange: it is everywhere continuous but nowhere differentiable; it is infinitely long but bounds a finite area. It's the limit of a sequence of curves. Here is how the sequence is generated.

1. The first curve is an equilateral triangle.
2. For k>1, the kth curve is generated from the (k−1)th by erecting an outward-pointing equilateral triangle with the middle third of each side of the (k−1)th curve as base and then erasing that base. (See Figure 1 for the first few curves of the sequence.)

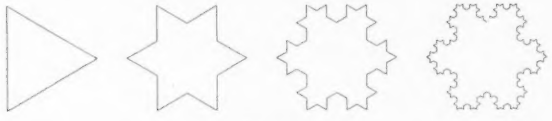


Figure 1

There are at least two possible generalizations of this process: we can use regular n-gons instead of just triangles, and we can go inward instead of outward. (Figure 2 shows an inward-going octagon and an outward-going pentagon.) The subroutine at the end of the article allows these variations. (People seriously interested in such generalizations and other strange curves and surfaces should refer to Martin Gardner's *Sixth Book of Mathematical Games from Scientific American*, Chapter 22, and his *Mathematical Games* column of December, 1976.)

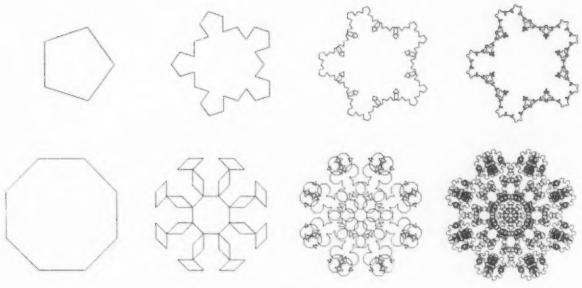


Figure 2

How The Algorithm Works

The subroutine supposes we have a plotter that behaves like Seymour Papert's turtle: the plotter pen will accept directions telling it where it should move to and whether it should leave tracks. The idea here, though, is to work with the pen's current position and direction and tell it how to turn before it moves by generating a string of turn instructions.

Some notation:

n = the number of sides of the polygon used.

theta = the angle of the triangle formed by joining two adjacent vertices with the n-gon's center (with one vertex at the center). Its measure is 2*pi/n radians.

Now, suppose we look at three edges of an n-gon (Figure 3): from the diagram it can be seen that to draw an n-gon, we must move from our initial point (B here) in the direction pi-theta, then, n-1 times, turn −theta and move again. (Note that though the diagram makes one think that this will not work for n=3, it holds even then.)

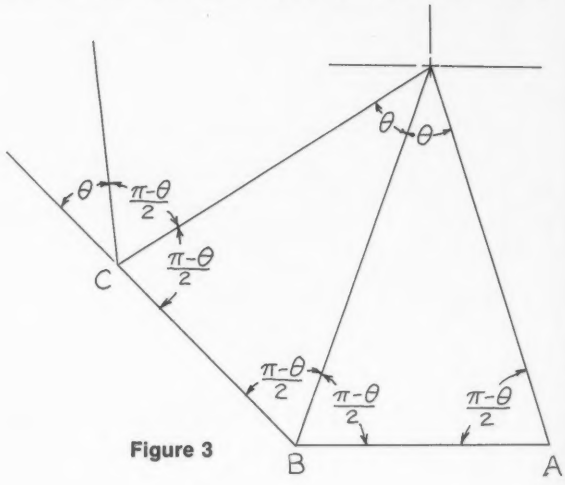


Figure 3

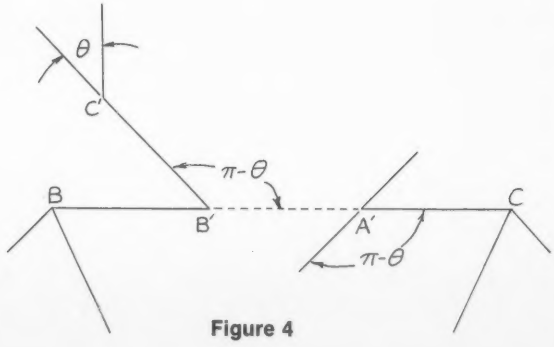


Figure 4

Next, given a side upon which we must erect a new n-gon (Figure 4): again from the diagram it is obvious (and even works) that to do such a thing, one must move in the direction one originally intended, turn pi-theta and move, then n− times, turn −theta and move, followed by a turn of pi−theta. The next move will bring you to the vertex you thought you would be at in the first place, if you move one third as far as at the higher level. With a little thought, it will even become obvious that this argument will hold just as well for inward-growing snowflakes; just change the signs of the turn angles.

Thus, to draw a snowflake curve:

let p1, p2, . . . , pn be the vertices of the lowest-level polygon. start at p1.

for i=1 to n−1
    move from pi to p(i+1)
next i

"Moving" here has the following special meaning — to move from pk to p(k+1),

move 1/3 of the way from pk to p(k+1). the point you are now at is to be a vertex q1 on the base of a new n-gon with vertices q1, q2, . . . ,qn.

for i=1 to n
    move from qi to q(i+1)
next i
    move from qn to p(k+1)

Notice that "moving" is now defined in terms of itself (this is called **recursive** definition). This version will draw the limit curve, the true snowflake, or it would if it actually let the turtle —er— **move.** The turtle given these instructions was last overheard muttering to itself . . .

To move from p1 to p2, I first move from p1 to q1, one-third of the way to p2. That means I must first move from q1 to r1, one-third of the way to q2. But to do **that**, . . .

So, we must specify a maximum depth of recursion, and tell the turtle to **actually** move once that depth is reached. (Let's say "travel" instead.) Now, moving is done like this:

if maximum depth of recursion has been reached,
    travel to p(i+1)
else move 1/3 of the way from p(i) to p(i+1)
    etc.

This method requires a little finesse in BASIC. We can handle the flow of control in "moving" because BASIC keeps a stack of return points, but all variables are global in BASIC. The messy business of stacking values of variables can be handled with arrays, using the counter of recursion depth as a subscript indicating the next available space in the arrays. It may look as if we intend to keep all n vertices at each level, but we can generate successive points as described earlier.

Being basically cheap, we don't want to use actual angles. That would make us calculate the unit vector in the direction the turtle is traveling with each move, meaning potentially huge numbers of sine and cosine evaluations with each snowflake. Fortunately, it's not necessary.

Consider the sequence of angles occurring in the drawing of a single regular n-gon:

pi−theta, pi−2*theta, pi−3*theta, . . . , pi−n*theta =−pi

or, since theta=2*pi/n,

pi*(1−2/n), pi*(1−4/n), pi*(1−6/n), . . . , pi*(1−2*n/n)= ±pi.

If n is even, all those angles are multiples of 2*pi/n, if n is odd all are multiples of pi/n. Since turning is simply the addition of angles, and pi±theta=pi*(n−2)/n is also a multiple of 2*pi/n or pi/n respectively, no matter what depth we go to, all the turtle's directions must be multiples of the appropriate angle. Thus we can generate vectors in the possible directions (there are 2*n if n is odd, otherwise there are n) once, and use an integer subscript into the table of vectors to indicate the current direction.

It is possible to write a faster snowflake drawing routine, using a list of pointers into an array of turn instructions. This method can take advantage of the uniform length of steps the turtle takes. The turtle, in effect, reads the instructions and follows its nose. The only problem with that, though, is that any mistakes made by the turtle (who **will** make them; see "The Square Root of 4 is not 2," Jan '78 *Creative Computing*) are compounded since it never looks ahead. The higher the snowflake order and the more sides on the polygon, the worse the discrepancy gets. ■

ALGOL Program Listing

```
     STANFORD ALGOL W (25MAR73)    SNOWFLAKE

0000 1- BEGIN
0001 -- PROCEDURE FLAKE(REAL VALUE SIZE,XINIT,YINIT; INTEGER VALUE DEPTH,N;
0003 --    LOGICAL VALUE OUT);
0004 2- BEGIN
0005 --    COMMENT
0005 --       A SNOWFLAKE CURVE PLOTTING PROCEDURE, WRITTEN BY JAMES JONES.
0005 --       ***BASED ON AN IDEA BY RAYMOND SCHLECHT. THANKS ALSO TO
0005 --          ROBERT KLOTZ. WITHOUT WHOM NOT MUCH WOULD HAVE HAPPENED.***
0005 --
0005 --          THIS RECURSIVE VERSION OF FLAKE AVOIDS SOME OF THE PROBLEMS
0005 --          WITH ROUNDOFF ERROR THAT THE PREVIOUS VERSION FELL INTO.
0005 --          THE USE OF WEND FORCES THE PREDICTION OF THE GOAL POINT,
0005 --          AND THE USE OF THE GOAL POINT PREVENTS THE ACCUMULATION
0005 --          OF ERRORS WHILE MOVING ALONG THE EDGE.
0005 --
0005 --       PARAMETERS:
0005 --          SIZE: RADIUS OF A CIRCLE THAT THE CURVE SHOULD FIT INTO
0005 --             (PLEASE NOTE: THE BOUNDS CALCULATED ARE SUCH THAT THEY
0005 --             DO NOT DEPEND UPON DEPTH AND THUS ARE NOT LEAST UPPER
0005 --             BOUNDS. IT IS WRITTEN THIS WAY TO PROVIDE A MARGIN OF
0005 --             SAFETY IN THE CURVE SIZE. AS WELL AS TO ALLOW THE
0005 --             PLOTTING OF THE SAME N-GON WITH DIFFERING DEPTHS WHILE
0005 --             ALLOWING A BASIS FOR COMPARISON BETWEEN THEM.)
0005 --          XINIT,YINIT: COORDINATES OF CURVE CENTER
0005 --          DEPTH: LEVEL OF CURVE--I.E., NUMBER OF TIMES FLAKIFYING IS
0005 --             DONE MINUS 1
0005 --          N: NUMBER OF SIDES OF POLYGON TO BE FLAKIFIED
0005 --          OUT: INDICATES WHETHER FLAKIFYING SHOULD BE OUTWARD OR
0005 --             INWARD (TRUE INDICATES OUTWARD)
0005 --
0005 --       WARNING:
0005 --          AN OUTWARD-GROWING PENTAGON MAY GROW SOMEWHAT LARGER THAN
0005 --          SPECIFIED. WE HAVE NOT BEEN ABLE TO DERIVE A VALID BOUND FOR
0005 --          THE PENTAGON IN THIS CASE. ALTHOUGH THE BOUND FOR THE OTHERS
0005 --          IS VALID AND THE PENTAGON'S PRESUMED BOUND IS, WE THINK,
0005 --          NEARLY CORRECT.
0005 --
0005 --    INTEGER NDIR,TWO_N; LOGICAL N_ODD;
0007 --    N_ODD:=ODD(N);
0008 --    TWO_N:=2*N;
0009 --    NDIR:=IF N_ODD THEN TWO_N ELSE N;
0011 3-    BEGIN
0012 --       LONG REAL ARRAY X,Y(0::NDIR-1);
0013 --       LONG REAL ARRAY SIDE(1::DEPTH);
0014 --       LONG REAL ANGLE;
0015 --       INTEGER DIR,LCWTURN,HIGHTURN1,HIGHTURN2;
0016 --       INTEGER LEVEL;
0017 --       LONG REAL S0,X0,Y0,X1,Y1,XK,YK;
0018 --
0018 --       LONG REAL PROCEDURE LONGCOT(LONG REAL VALUE X);
0019 --          LONGCOS(X)/LONGSIN(X);
0020 --
0020 --       INTEGER PROCEDURE SUB(INTEGER VALUE K);
0021 --          COMMENT
0021 --             SUB RETURNS THE SUBSCRIPT INTO THE X AND Y ARRAYS
0021 --             CORRESPONDING TO K, WHERE K REPRESENTS THE ANGLE
0021 --             PI*(K/N) RADIANS.
0021 --
0021 --
0021 --          (IF K<0 THEN TWO_N+K ELSE K) DIV (IF N_ODD THEN 1 ELSE 2);
0024 --
0024 --       INTEGER PROCEDURE CHEAPMOD(INTEGER VALUE K);
0025 --          COMMENT
0025 --             CHEAP MOD FUNCTION, WHICH CAN BE USED SINCE
0025 --             WE KNOW WE NEVER ADD MORE THAN NDIR TO DIR, AND
0025 --             WE ARE ONLY ADDING TO IT.
0025 --          ;
0025 --          IF K>=NDIR THEN K-NDIR ELSE K;
0027 --
0027 --       PROCEDURE WEND(LONG REAL VALUE X0,Y0,X1,Y1);
0028 4-       BEGIN
0029 --          COMMENT
0029 --             HOW TO MAKE YOUR WAY FROM POINT (X0,Y0) TO
0029 --             POINT (X1,Y1).
0029 --             ***WARNING***
0029 --             THIS PROCEDURE TAKES ADVANTAGE OF THE FACT
0029 --             THAT CALL BY VALUE PARAMETERS MAY BE CHANGED WITH
0029 --             IMPUNITY. CONVERTERS TO OTHER LANGUAGES TAKE NOTE
0029 --          ;
0029 --          LONG REAL XK,YK,SK;
0030 --          LEVEL:=LEVEL+1;
0031 --          IF LEVEL>DEPTH THEN PLOT(X1,Y1,2)
0031 5-          ELSE BEGIN
```

```
0033 --              COMMENT
0033 --                 MOVE IN CURRENT DIRECTION A THIRD OF THE WAY--
0033 --              ;
0033 --              SK:=SIDE(LEVEL);
0034 --              XK:=XO+SK*X(DIR);
0035 --              YK:=YO+SK*Y(DIR);
0036 --              WEND(XO,YO,XK,YK);
0037 --              COMMENT
0037 --                 THEN ESTABLISH CORNER OF NEXT-LEVEL N-GON
0037 --                 AND TRAVEL FROM VERTEX TO VERTEX...
0037 --              ;
0037 --              XO:=XK;
0038 --              YO:=YK;
0039 --              DIR:=CHEAPMOD(DIR+HIGHTURN1);
0040 --              XK:=XK+SK*X(DIR);
0041 --              YK:=YK+SK*Y(DIR);
0042 --              WEND(XO,YO,XK,YK);
0043 6-             FOR I:=3 UNTIL N DO BEGIN
0044 --                 XO:=XK;
0045 --                 YO:=YK;
0046 --                 DIR:=CHEAPMOD(DIR+HIGHTURN2);
0047 --                 XK:=XK+SK*X(DIR);
0048 --                 YK:=YK+SK*Y(DIR);
0049 --                 WEND(XO,YO,XK,YK)
0049 -6             END;
0050 --              COMMENT
0050 --                 ...EXCEPT THE LAST ONE. INSTEAD, MOVE THE REMAINING
0050 --                 THIRD OF THE WAY ALONG EDGE OF PREVIOUS LEVEL N-GON.
0050 --              ;
0050 --              DIR:=CHEAPMOD(DIR+HIGHTURN1);
0051 --              WEND(XK,YK,X1,Y1)
0051 -5           END;
0052 --           LEVEL:=LEVEL-1
0052 -4        END WEND;
0053 --
0053 --           COMMENT
0053 --              CALCULATE THE UNIT VECTORS IN THE POSSIBLE DIRECTIONS.
0053 --           ;
0053 4-        FOR I:=0 UNTIL NDIR-1 DO BEGIN
0054 --           ANGLE:=(2*I/NDIR)*PI;
0055 --           X(I):=LONGCOS(ANGLE);
0056 --           Y(I):=LONGSIN(ANGLE)
0056 -4        END;
0057 --           COMMENT
0057 --              CALCULATE THE POLYGON SIDELENGTHS AT EACH LEVEL.
0057 --              AND STORE THEM IN THE ARRAY SIDE.
0057 --           ;
0057 --        SO:=SIZE*2*LONGSIN(PI/N)/
0057 --           (IF OUT THEN
0057 --              (IF N_ODD THEN
0057 --                 (IF N=3 THEN 1.0L
0057 --                 ELSE 0.5L*LONGCOS(PI/N)*
0058 --                    LONGSQRT(10.0L+6.0L*LONGCOS(PI/N)) )
0058 --              ELSE 2.0L)
0059 --           ELSE 1.0L);
0061 --        SIDE(1):=SO;
0062 --        FOR I:=2 UNTIL DEPTH DO SIDE(I):=SIDE(I-1)/3;
0063 --           COMMENT
0063 --              DETERMINE TURN ANGLES
0063 --           ;
0063 --        LOWTURN:=SUB(-2);
0064 --        HIGHTURN1:=SUB(IF OUT THEN N-2 ELSE 2-N);
0066 --        HIGHTURN2:=SUB(IF OUT THEN -2 ELSE 2);
0068 --           COMMENT
0068 --              LOCATE THE BEGINNING CORNER OF THE CURVE
0068 --           ;
0068 --        LEVEL:=1;
0069 --        XO:=X1:=XINIT-SO/2;
0070 --        YO:=Y1:=YINIT-SO*LONGCOT(PI/N)/2;
0071 --        PLOT(XO,YO,3);
0072 --        DIR:=SUB(N-2);
0073 --           COMMENT
0073 --              THEN WEND YOUR WAY FROM VERTEX TO VERTEX OF THE
0073 --              THE BOTTOM-LEVEL N-GON.
0073 --           ;
0073 --        XK:=XO+SO*X(DIR);
0074 --        YK:=YO+SO*Y(DIR);
0075 --        WEND(XO,YO,XK,YK);
0076 4-        FOR I:=2 UNTIL N-1 DO BEGIN
0077 --           XO:=XK;
0078 --           YO:=YK;
0079 --           DIR:=CHEAPMOD(DIR+LOWTURN);
0080 --           XK:=XO+SO*X(DIR);
0081 --           YK:=YO+SO*Y(DIR);
0082 --           WEND(XO,YO,XK,YK)
0082 -4        END;
0083 --           COMMENT
0083 --              SINCE I AM BASICALLY PARANOID, I USE THE SAVED
0083 --              COORDINATES OF THE BEGINNING POINT FOR THE LAST WE
0083 --
0083 --        DIR:=CHEAPMOD(DIR+LOWTURN);
0084 --        WEND(XK,YK,X1,Y1)
0084 -3        END
0084 -2     END FLAKE;
0085 --
0085 --     PROCEDURE PLOT(REAL VALUE X,Y; INTEGER VALUE IPEN);
0087 --        COMMENT
0087 --              THIS IS THE ALGOL W WAY TO LINK TO THE ROUTINE TH
0087 --              PLOTTING HERE AT OU. I'M SURE IT VARIES WILDLY FR
0087 --              STANDARDS AT A GREAT MANY PLACES. SO WATCH OUT AN
0087 --              TO FIT YOUR INSTALLATION.
0087 --        ;
0087 --        FORTRAN "PLOT";
0088 --
0088 --     COMMENT
0088 --     THE PROCEDURE FLAKE DOES ALL THE DIRTY WORK. IT WAS WRITTEN TO
0088 --     ALLOW PEOPLE TO WRITE THINGS TO CALL IT. SO THEY CAN THINK OF
0088 --     FLAKIFYING A POLYGON AS JUST ANOTHER PLOTTER FEATURE.
0088 --     (SERMONETTE--THIS IS THE WAY THINGS SHOULD BE WRITTEN! READ
0088 --     KERNIGHAN AND PLAUGER'S "SOFTWARE TOOLS.")
0088 --     THIS IS A DRIVER FOR THE FLAKE PROCEDURE. IT CAN BE CHANGED TO DO
0088 --     A GREAT MANY DIFFERENT THINGS FROM WHAT IS DONE HERE. SO DON'T
0088 --     GIVE IT MUCH THOUGHT. BE CREATIVE...
0088 --     ;
0088 --     REAL PLOTSIZE;
0089 --     REAL SIZE;
0090 --     REAL RADIUS,XBOUND,YBOUND;
0091 --     INTEGER DEPTH,N;
0092 --     LOGICAL OUT;
0093 --     XBOUND:=YBOUND:=0.0;
0094 --     INTFIELDSIZE:=3;
0095 --     READ(PLOTSIZE);
0096 --     PLOT(0.0,-10.0,-3);
0097 --     READ(RADIUS,DEPTH,N,OUT);
0098 2-     WHILE RADIUS>0.0 DO BEGIN
0099 --        SIZE:=2.0*RADIUS;
0100 3-     IF YBOUND+SIZE+2.0>PLOTSIZE THEN BEGIN
0101 --           PLOT(XBOUND+2.0,-PLOTSIZE,-3);
0102 --           XBOUND:=YBOUND:=0.0
0102 -3        END;
0103 3-     IF XBOUND<RADIUS THEN BEGIN
0104 --           PLOT(RADIUS-XBOUND,0.0,-3); XBOUND:=RADIUS
0105 -3        END;
0106 --        YBOUND:=YBOUND+SIZE+2.0;
0107 --        PLOT(0.0,RADIUS+1.0,-3);
0108 --        WRITE(" ");
0109 --        WRITE("SNOWFLAKE SIZE=",SIZE,"TO",DEPTH,"LEVELS:",N,"-GON USED--",
0109 --           "MOTION ",IF OUT THEN "OUTWARD" ELSE "INWARD");
0111 --        FLAKE(RADIUS,0.0,0.0,DEPTH,N,OUT);
0112 --        PLOT(0.0,RADIUS+1.0,-3);
0113 --        READ(RADIUS,DEPTH,N,OUT)
0113 -2        END;
0114 --        PLOT(0.0,0.0,999);
0115 --        WRITE("      I QUIT ")
0115 -1           END.

EXECUTION OPTIONS: DEBUG,1  NOCHECK TIME=10 SECONDS PAGES=20

000.74 SECONDS IN COMPILATION, (05884, 02272) BYTES OF CODE GENERATED
```

BASIC Program Listing

```
JEJ.BASIC.DATA
1000 REM ***BASIC SNOWFLAKE PLOTTER***
1010 REM    WRITTEN BY JAMES JONES
1020 REM BASED ON AN IDEA BY RAYMOND SCHLECHT. THANKS ALSO TO
1030 REM ROBERT KLOTZ, WITHOUT WHOM NOT MUCH WOULD HAVE HAPPENED.
1040 REM ADAPTED FROM ALGOL FOR MITS BASIC 4-23-78
1050 REM THIS IS THE RECURSIVE FORM, WHICH AVOIDS A GREAT DEAL
1060 REM OF ROUNDOFF ERROR AS DESCRIBED IN THE ARTICLE.

1070 REM PARAMETERS:
1080 REM    SZ: RADIUS OF A CIRCLE THAT THE CURVE SHOULD FIT INTO
1090 REM       (PLEASE NOTE: THE BOUNDS ARE SUCH THAT THEY DO NOT DE-
1110 REM       PEND ON DP AND THUS ARE NOT LEAST UPPER BOUNDS. IT
1120 REM       IS WRITTEN THIS WAY TO PROVIDE A MARGIN OF SAFETY IN
1130 REM       THE CURVE SIZE, AS WELL AS TO ALLOW THE PLOTTING OF THE
1140 REM       SAME N-GON WITH DIFFERING DEPTHS WHILE ALLOWING A BASIS
1150 REM       FOR COMPARISON.)
1160 REM    XI,YI: COORDINATES OF THE CURVE CENTER
1170 REM    DP: LEVEL OF CURVE; ONE LESS THAN THE NUMBER OF TIMES
1180 REM       DIVISION OF SIDES INTO THIRDS IS TO BE DONE.
1190 REM    N: NUMBER OF SIDES OF THE INITIAL POLYGON
1200 REM    GO: STANDS FOR GROW OUTWARD; TRUE IF THE CURVE IS TO
1210 REM       DO SO.

1220 REM WARNING: AN OUTWARD GROWING PENTAGON MAY GROW A LITTLE LARGER
1230 REM    THAN SPECIFIED. WE DON'T KNOW WHAT THE EXACT BOUND FOR IT
1240 REM    IS, BUT THE FORMULA IN THE ROUTINE WORKS FOR OTHER CASES
1250 REM    AND IS NEARLY CORRECT FOR THE PENTAGON, WE THINK...

1260 REM LOCAL VARIABLES:
1270 REM PI: THE USUAL...
1280 REM UP, DOWN: PARAMETERS FOR THE PSEUDO-PLOT ROUTINE.
1290 REM      THEY ARE ACTUALLY MEANINGLESS BUT ARE USED TO
1300 REM      SIGNIFY PEN POSITION.
1310 REM NE: OR 'N EVEN'; TRUE IF N IS EVEN
1312 REM ND: NUMBER OF POSSIBLE DIRECTIONS OF TRAVEL
1314 REM DI: CURRENT DIRECTION
1316 REM LT: TURN FOR LOWEST-LEVEL POLYGON
1318 REM H1,H2: TURNS FOR UPPER-LEVEL POLYGONS
1320 REM DM: DP-1; USED TO AVOID SUBTRACTION IN RECURSIVE ROUTINE
1330 REM X,Y: HOLD UNIT VECTORS IN ALL POSSIBLE DIRECTIONS
1340 REM S: HOLDS SIDE LENGTHS FOR ALL LEVELS
1350 REM XOS,XKS,X1S,YOS,YKS,Y1S,IS,SS: STACK ARRAYS

1360 REM LOCAL ARRAYS ARE DIMENSIONED HERE TO INDICATE THE MINIMUM
1370 REM POSSIBLE SIZE. ONE CAN DELETE THEM AFTER EACH INVOCATION
1380 REM OR DIMENSION THEM TO THE MAXIMUM ALLOWABLE SIZE OUTSIDE OF
1390 REM THE ROUTINE.

1400 PI=3.1415927
1410 UP=3: DOWN=2: DM=DP-1
1420 NE=(N MOD 2=0)
1430 IF NE THEN ND=N ELSE ND=2*N
1440 DIM X(ND-1),Y(ND-1),S(DP)

1450 REM THE FOLLOWING ARRAYS ARE USED AS STACKS TO SAVE VALUES
1460 REM OF VARIABLES CORRESPONDING TO CALL-BY-VALUE PARAMETERS
1470 REM IN THE ORIGINAL ALGOL PROCEDURE
1480 DIM XOS(DP),XKS(DP),X1S(DP),YOS(DP),YKS(DP),Y1S(DP),IS(DP),SS(DP)

1490 REM CALCULATE POSSIBLE UNIT VECTORS
1500 FOR I=0 TO ND-1
1510     A=2*PI*I/ND
1520     X(I)=COS(A):Y(I)=SIN(A)
1530 NEXT I

1540 REM DETERMINE SIDE LENGTHS
1550 S(0)=2*SZ*SIN(PI/N)
1560 IF GO OR N=3 THEN 1600
1570    IF NE THEN S(0)=S(0)/2: GOTO 1600
1580       C=COS(PI/N)
1590       S(0)=2*S(0)/(C*SQR(10+6*C))
1600 FOR I=1 TO DP
1610     S(I)=S(I-1)/3
1620 NEXT I

1630 REM INITIALIZATION OF POSITION
1640 LV=0
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```
1650 X0=X1-S(0)/2: X1=X0: XK=X1
1660 Y0=Y1-S(0)/(2*TAN(PI/N)): Y1=Y0: YK=Y1
1670 IP=UP: GOSUB 2000: IP=DOWN

1680 REM DETERMINE TURN VALUES FOR BOTTOM AND UPPER LEVELS
1690 DI=N-2
1700 LT=2*N-2
1710 H1=N-2:H2=-2
1720 IF NOT GO THEN H1=-H1: H2=-H2
1730 IF H1<0 THEN H1=H1+2*N ELSE H2=H2+2*N
1740 IF NE THEN DI=DI/2: LT=LT/2: H1=H1/2: H2=H2/2

1750 REM DRAW FIRST BOTTOM-LEVEL 'SIDE'
1760 XK=X0+S(0)*X(DI): YK=Y0+S(0)*Y(DI)
1770 GOSUB 3000

1780 REM DRAW 2ND THROUGH (N-1)TH (TURNING REQUIRED)
1790 FOR I=2 TO N-1
1800     XO=XK: YO=YK
1810     DI=(DI+LT) MOD ND
1820     XK=XO+S(0)*X(DI): YK=YO+S(0)*Y(DI)
1830     GOSUB 3000
1840 NEXT I

1850 REM DRAW FINAL 'SIDE'---IT IS SEPARATE BECAUSE WE
1860 REM HAVE SAVED THE INITIAL COORDINATES IN (X1,Y1)
1870 REM AND DON'T TRUST REPEATED ADDITION TO BE AS
1880 REM ACCURATE. (REMEMBER, OUR TURTLE IS INTELLIGENT!)
1890 DI=(DI+LT) MOD ND
1900 XO=XK: YO=YK: XK=X1: YK=Y1
1910 GOSUB 3000
1920 RETURN

2000 PRINT XK,YK
2010 RETURN
2020 REM THIS IS THE 'PLOT' ROUTINE USED FOR DEBUGGING
2030 REM AND INCLUDED HERE FOR COMPLETENESS' SAKE. OUR
2040 REM ALTAIR HAS NO PLOTTER, AND THIS WAS USED TO TEST
2050 REM THE ACCURACY OF THE TRANSLATION FROM ALGOL.
2060 REM FOR AN INTERESTING EFFECT, TRY THE FOLLOWING
2070 REM TRANSFORMATION:
2080 REM     TURN (XK,YK) INTO POLAR COORDINATES
2090 REM     (R,THETA), THEN WARP AS FOLLOWS--
2100 REM     (R,THETA)->(RMAX*(1-EXP(-K*R)),THETA)
2110 REM     THEN TURN BACK INTO RECTANGULAR COORDINATES
2120 REM     FOR PLOTTING.
2130 REM K SHOULD BE BETWEEN 0 AND 1.

2900 REM "MOVING" FROM ONE POINT (XO,YO) TO ANOTHER (XK,YK)
3000 IF LV>=DM THEN GOSUB 2000: RETURN
3010 REM STACKING OF VARIABLES CHANGED DURING GOSUB
3020 XOS(LV)=XO: XKS(LV)=XK: X1S(LV)=X1
3030 YOS(LV)=YO: YKS(LV)=YK: Y1S(LV)=Y1
3040 IS(LV)=I: SS(LV)=SK
3050 LV=LV+1

3055 REM OUR DESTINATION IS (XK,YK), SO WE SAVE IT
3057 REM IN X1 AND Y1
3058 X1=XK: Y1=YK

3060 REM MOVE A THIRD OF THE WAY IN THE CURRENT DIRECTION
3070 SK=S(LV)
3080 XK=XO+SK*X(DI): YK=YO+SK*Y(DI)
3090 GOSUB 3000

3100 REM MAKE FIRST "MOVE" FOR NEXT-LEVEL POLYGON
3110 XO=XK: YO=YK
3120 DI=(DI+H1) MOD ND
3130 XK=XO+SK*X(DI): YK=YO+SK*Y(DI)
3140 GOSUB 3000

3150 REM MAKE "MOVES" FOR INTERMEDIATE EDGES OF POLYGON
3160 FOR I=3 TO N
3170     XO=XK: YO=YK
3180     DI=(DI+H2) MOD ND
3190     XK=XO+SK*X(DI): YK=YO+SK*Y(DI)
3200     GOSUB 3000
3210 NEXT I

3220 REM THEN THE FINAL EDGE, REMEMBER, THE TURTLE KNOWS
3230 REM WHERE IT SHOULD END UP AND NEED NOT CALCULATE IT.
3240 DI=(DI+H1) MOD ND
3250 XO=XK: YO=YK: XK=X1: YK=Y1
3260 GOSUB 3000

3270 REM VARIABLE UNSTACKING
3280 LV=LV-1
3290 XO=XOS(LV): XK=XKS(LV): X1=X1S(LV)
3300 YO=YOS(LV): YK=YKS(LV): Y1=Y1S(LV)
3310 I=IS(LV): SK=SS(LV)
3320 RETURN
```

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The game programs in this issue (JOUST, CORRAL and PUZZLE) are special preprints from our forthcoming book, More BASIC Computer Games. *Like the popular* BASIC Computer Games: Microcomputer Edition, *this book will contain over 100 game programs in Microsoft BASIC. They can be run, with little or no modification, on your TRS-80 Level II, PET, Apple II with Applesoft, Exidy Sorcerer or OSI Challenger, and can be converted to most other BASICs. Complete descriptions, LISTs and RUNs are given for each program. This book includes about 50 programs previously published in Creative Computing magazine, converted to Microsoft BASIC, and another 50 game programs never before published. Order your advance copy now, for $7.50, plus $1.00 for postage and handling, from: Creative Computing, P.O. Box 789-M, Morristown, NJ 07960.*

CORRAL

by Colin Keay

CORRAL is a game program inspired by Harry (short for Aragon), a horse acquired in a rash moment of indulgence for a teen-age daughter. Harry, in his own inimitable style, taught us much about the care, feeding and psychology of the equine species. Some of that hard-won psychology has found its way into CORRAL, which is a one-dimensional simulation of the two- (and almost three-) dimensional problem of catching Harry for anything other than food. The main reason for confining Harry's alter ego in the computer to only one dimension is simply to conserve paper on hard-copy terminals. Even so, the presentation is very effective on a video display unit.

The corral itself is bounded by a pair of siderails represented by upper-case I characters separated by 21 spaces. The cowboy C always enters beside the leftmost rail while the horse H is happily mooching somewhere between positions 10 and 18 with a bias towards the right. This bias and the various other behavioral peculiarities of the horse are governed by two data matrices (statements 90 and 100) which may be altered to vary the beast's temperament from wild to docile depending on the data distribution.

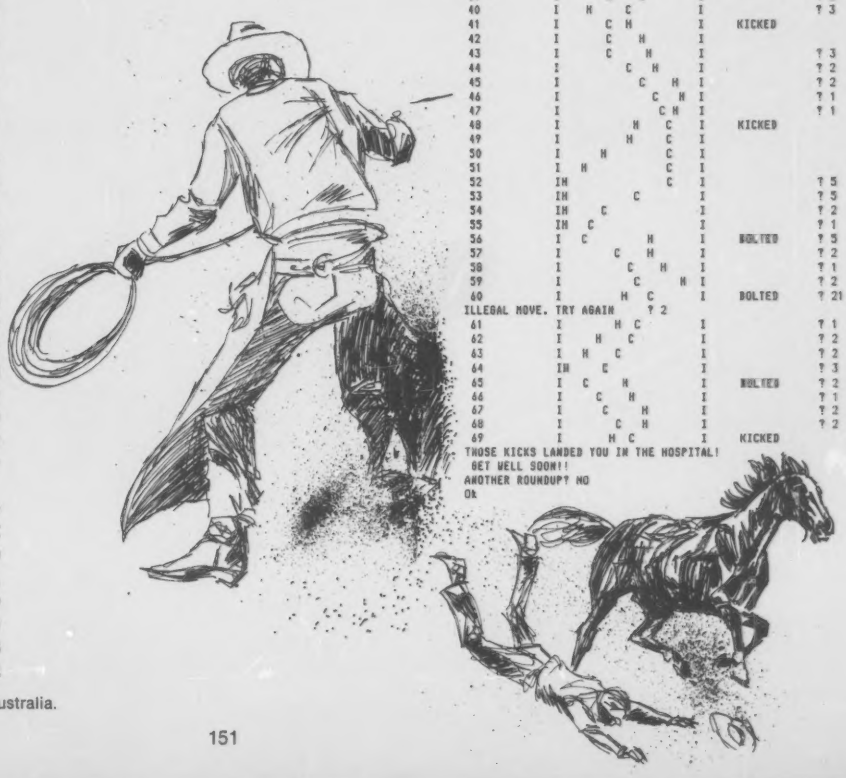
If the horse bolts, a check is made (line 450) to ensure that it does not reach a position less than one space away from the cowboy. Occasionally, the horse bolts to a position more advantageous to the cowboy, just as in real life, but usually the opposite is true, particularly when it bolts as a result of an incautious approach by the cowboy. So heed with care the advice for the cowboy not to advance by more than half the separation in any one move except when adjacent to the horse, of course!

The probability that the horse may kick when the cowboy moves close is set by the IF statement at line 500. The cowboy is immobilized for from one to five moves, while the horse canters happily away from the scene of his triumph. If this happens more than a certain (random) number of times the round-up is terminated by the departure of the cowboy in an ambulance.

Occasionally the horse decides to engage in a friendly dance around the cowboy, but remember that random number generators have no soul and the result is often vile treachery as the horse delivers a fatal kick at the very moment when a successful catch seems assured. On the other hand, the skill of an accomplished CORRAL cowboy can result in a catch within three moves with no injuries sustained. You either have it or you have not, as the saying goes. In the latter case the program allows a maximum of 100 moves before relegating the luckless cowboy to cookhouse chores.

Computer freaks with multi-color graphics on their busses will no doubt be dissatisfied with such prosaic symbols as H and C for the horse and cowboy. A fully animated CORRAL in living color (with synthesized sound effects by Votrax — a talking horse yet!) should not be too difficult to achieve. ■

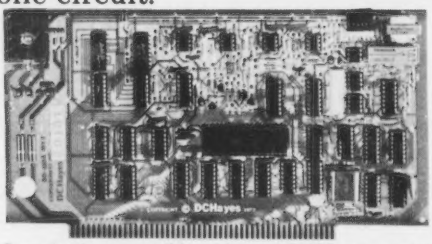
```
RUN

  YOU ARE THE COWBOY.  GO CATCH YOUR HORSE IN THE CORRAL!
DO YOU WANT FULL INSTRUCTIONS? YES
YOU MOVE TOWARD YOUR HORSE 1 TO 5 STEPS AT A TIME.
IF YOU MORE THAN HALVE THE SEPERATION HE WILL BOLT!
HE MAY ALSO BOLT WHEN HE IS CLOSE TO THE RAIL
WHEN YOU COME WITHIN 2 STEPS HE MAY KICK.  SO LOOKOUT!!

AFTER '?' TYPE IN DIGIT FROM 1 TO 5 FOR COWBOY'S NEXT MOVE

 0          IC              H    I                ? 5
 1          I    C               H I                ? 3
 2          I       C             HI                ? 3
 3          I          C          HI                ? 3
 4          I             C       HI                ? 2
 5          I                C    H I               ? 1
 6          I           H     C    I     BOLTED     ? 2
 7          I            H  C      I                ? 1
 8          I            H C       I                ? 1
 9          I            HC        I                ? 1
 10         I          H C         I                ? 1
 11         I          HC          I                ? 1
            I          H           I

YIPPEE!!  NOW SEE IF YOU CAN CATCH HIM IN FEWER MOVES
ANOTHER ROUNDUP? YES

 0          IC              H    I                ? 5
 1          I    C               H I                ? 5
 2          I          C         HI                ? 5
 3          I             C    HI                ? 2
 4          I        H       C  I     BOLTED     ? 3
 5          I     H          C  I                ? 2
 6          I     H     C       I                ? 3
 7          I  H     C          I                ? 3
 8          I H   C             I                ? 2
 9          I H E               I                ? 1
 10         I H C               I                ? 1
 11         I  C         H      I     BOLTED     ? 3
 12         I     C  H          I                ? 2
 13         I        C H        I                ? 1
 14         I          C  H     I                ? 2
 15         I             C  H  I                ? 2
 16         I                C  H I               ? 1
 17         I                C    H I             ? 2
 18         I                   E  HI             ? 1
 19         I              H    C   I     BOLTED     ? 1
 20         I              H    C   I                ? 2
 21         I                   C H   I     KICKED
 22         I                   C     HI
 23         I                   C     HI
 24         I                   C     HI
 25         I                   C     HI                ? 3
 26         I                      C  HI                ? 1
 27         I                 H    C   I     BOLTED     ? 3
 28         I              H     C      I                ? 2
 29         I           H     C         I                ? 2
 30         I           H  C            I                ? 1
 31         I        H     C            I                ? 2
 32         I     H  C                  I                ? 1
 33         I        C  H               I     KICKED
 34         I        C        H         I
 35         I        C           H      I
 36         I        C              H   I                ? 5
 37         I                 C       H  I                ? 3
 38         I           H        C      I     BOLTED     ? 2
 39         I           H     C         I                ? 2
 40         I     H     C               I                ? 3
 41         I        C  H               I     KICKED
 42         I        C     H            I
 43         I        C        H         I                ? 3
 44         I           C     H         I                ? 2
 45         I              C     H      I                ? 2
 46         I                 C     H   I                ? 1
 47         I                    C  H   I                ? 1
 48         I              H     C      I     KICKED
 49         I              H     C      I
 50         I           H        C      I
 51         I     H              C      I
 52         IH                   C      I                ? 5
 53         IH              C           I                ? 5
 54         IH        C                 I                ? 2
 55         IH     C                    I                ? 1
 56         I  C              H         I     BOLTED     ? 5
 57         I              C     H      I                ? 2
 58         I                 C     H   I                ? 1
 59         I                    C     H I               ? 2
 60         I              H     C      I     BOLTED     ? 21
ILLEGAL MOVE. TRY AGAIN     ? 2
 61         I           H  C            I                ? 1
 62         I        H     C            I                ? 2
 63         I     H     C               I                ? 2
 64         IH       C                  I                ? 3
 65         I  C     H                  I     BOLTED     ? 2
 66         I     C  H                  I                ? 1
 67         I        C     H            I                ? 2
 68         I           C  H            I                ? 2
 69         I        H  C               I     KICKED
THOSE KICKS LANDED YOU IN THE HOSPITAL!
 GET WELL SOON!!
ANOTHER ROUNDUP? NO
Ok
```



Colin Keay, Physics Dept., Newcastle University, Australia.

```
LIST
10 PRINT TAB(26);"CORRAL"
20 PRINT TAB(20);"CREATIVE COMPUTING"
30 PRINT TAB(18);"MORRISTOWN, NEW JERSEY"
40 PRINT:PRINT:PRINT
50 DIM A(21)
60 DIM S(2,9)
70 FOR I=1 TO 2:FOR J=0 TO 9
80 READ S(I,J):NEXT J:NEXT I
90 DATA 0,1,2,3,3,3,2,2,1,0,-1
100 DATA 1,2,3,4,5,4,3,2,1,0
110 PRINT "  YOU ARE THE COWBOY.  GO CATCH YOUR HORSE IN THE CORRAL!"
120 INPUT "DO YOU WANT FULL INSTRUCTIONS";F$
130 IF LEFT$(F$,1)="N" GOTO 190
140 PRINT "YOU MOVE TOWARD YOUR HORSE 1 TO 5 STEPS AT A TIME."
150 PRINT "IF YOU MORE THAN HALVE THE SEPERATION HE WILL BOLT!"
160 PRINT "HE MAY ALSO BOLT WHEN HE IS CLOSE TO THE RAIL"
170 PRINT "WHEN YOU COME WITHIN 2 STEPS HE MAY KICK.  SO LOOKOUT!!"
180 PRINT
190 PRINT "AFTER '?' TYPE IN DIGIT FROM 1 TO 5 FOR COWBOY'S NEXT MOVE"
200 C=1:L=1:K=0:M=0:N=0:GOSUB 590
210 IF R>5 THEN Q=-Q
220 H=13+Q:GOSUB 600
230 T=2+P:PRINT
240 B$= "           "
250 FOR J=1 TO 21:A(J)=32:NEXT J
260 A(C)=67:A(H)=72
270 PRINT N,"I";
280 FOR J=1 TO 21:PRINT CHR$(A(J));:NEXT J
290 PRINT "I",B$;
300 X=ABS(H-C):L=SGN(H-C)
310 N=N+1:IF K>0 GOTO 540
320 IF N>100 THEN 730
330 INPUT D
340 IF D>0 AND D<6 GOTO 360
350 PRINT "ILLEGAL MOVE. TRY AGAIN",;:GOTO 320
360 E=C+L*D:IF E <1 OR E>21 THEN 350
370 C=E:GOSUB 590
380 G=P:N=N+L*G:GOSUB 600
390 IF X<2*D AND D >1 GOTO 440
400 IF N>1 AND N<20 THEN 480
410 GOSUB 590
420 IF R>2 GOTO 480
430 IF X>7 GOTO 240
440 G=P+2*P:N=N-L*G:L=-L:GOSUB 600
450 IF ABS(N-C)>1 THEN 470
460 N=N-3*L:GOSUB 600
470 B$="BOLTED     ":GOTO 250
480 IF ABS(N-C)>2 GOTO 240
490 GOSUB 590
500 IF R>3 GOTO 570
510 GOSUB 590
520 K=P+2:N=N+1:N=N-5*L:GOSUB 600
530 B$="KICKED":GOTO 250
540 IF R>7 GOTO 630
550 K=K-1:PRINT:GOSUB 590
560 N=N+L*(P+1):GOSUB 600:GOTO 240
570 IF N=C THEN 650
580 GOTO 240
590 R=INT(10*RND(1)):P=S(1,R):Q=S(2,R):RETURN
600 IF N<1 THEN N=1
610 IF N>21 THEN N=21
620 RETURN
630 PRINT:PRINT "THOSE KICKS LANDED YOU IN THE HOSPITAL!"
640 PRINT " GET WELL SOON!!":GOTO 700
650 FOR J=1 TO 21:A(J)=32:NEXT J:A(C)=35
660 PRINT ,"I";
670 FOR J=1 TO 21:PRINT CHR$(A(J));:NEXT J
680 PRINT "I"
690 PRINT:PRINT "YIPPEE!!  NOW SEE IF YOU CAN CATCH HIM IN FEWER MOVES"
700 INPUT "ANOTHER ROUNDUP";F$
710 IF LEFT$(F$,1)="Y" THEN 200
720 GOTO 740
730 PRINT:PRINT "ENOUGH!! YOU'D DO BETTER AS CAMP COOK!":GOTO 700
740 END
Ok
```

modem / 'mo • dəm / [**mod**ulator + **dem**odulator] *n - s* : a device for transmission of digital information via an analog channel such as a telephone circuit.



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Joust

by Alan Yarbrough

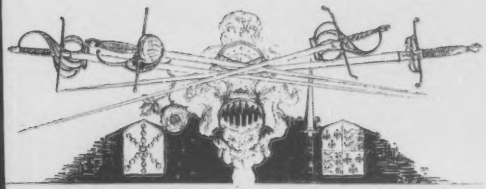
In this game, you're a medieval knight in a jousting tournament. You will challenge, in succession, the Gold Knight, the Silver Knight, the Red Knight and the Black Knight. The prize is the princess' hand in marriage. To joust, you select an aiming point for your lance, and then a defense position. Your choice of defensive positions will be determined by the way you aim your own lance.

The original version of Joust was done in BASIC on a PDP-11, but the program listing here is in Microsoft BASIC. ■

Alan Yarbrough, 128 Simons Rd., Lexington, MA 02173.


```
RUN

WHAT IS YOUR NAME, PLEASE? STEVE
SIR STEVE, YOU ARE A MEDIEVAL KNIGHT IN A JOUSTING TOURNAMENT.
THE PRIZE TO THE WINNER IS THE PRINCESS' HAND IN MARRIAGE.
TO WIN, YOU MUST BEAT FOUR OTHER KNIGHTS.
TO JOUST, YOU PICK AN AIMING POINT FOR THE LANCE,
AND THEN ONE OF FROM 3 TO 6 DIFFERENT POSSIBLE DEFENSE POSITIONS.
THE AIMING POINTS ARE:
1- HELM
2- UPPER LEFT (OF SHIELD)
3- UPPER MIDDLE
4- UPPER RIGHT
5- LOWER LEFT
6- LOWER MIDDLE
7- LOWER RIGHT
8- BASE OF SHIELD

IF YOU BREAK A LANCE OR LOSE A HELM, YOU WILL BE GIVEN ANOTHER.
GOOD LUCK, SIR!

THIS IS YOUR FIRST JOUST. YOU ARE UP AGINST THE GOLD KNIGHT.
YOUR AIMING POINT(1-8)? 4
YOU MAY USE ONE OF THESE DEFENSES:
        2-RIGHT LEAN, 4-STEADY SEAT, 5-SHIELD HIGH, 6-SHIELD LOW.
WHAT IS YOUR CHOICE? 2
HE HAS BROKEN HIS LANCE AND UNSEATED YOU (CLANG!)
YOU HIT HIS SHIELD BUT GLANCED OFF.
TOO BAD, YOU LOST. HOPE YOUR INSURANCE WAS PAID UP.
SORRY, BETTER LUCK NEXT JOUST.
Ok
```

```
WHAT IS YOUR NAME, PLEASE? STEVE
SIR STEVE, YOU ARE A MEDIEVAL KNIGHT IN A JOUSTING TUURNAMENT.
THE PRIZE TO THE WINNER IS THE PRINCESS' HAND IN MARRIAGE.
TO WIN, YOU MUST BEAT FOUR OTHER KNIGHTS.
TO JOUST, YOU PICK AN AIMING POINT FOR THE LANCE,
AND THEN ONE OF FROM 3 TO 6 DIFFERENT POSSIBLE DEFENSE POSITIONS.
THE AIMING POINTS ARE:
1- HELM
2- UPPER LEFT (OF SHIELD)
3- UPPER MIDDLE
4- UPPER RIGHT
5- LOWER LEFT
6- LOWER MIDDLE
7- LOWER RIGHT
8- BASE OF SHIELD

IF YOU BREAK A LANCE OR LOSE A HELM, YOU WILL BE GIVEN ANOTHER.
GOOD LUCK, SIR!

THIS IS YOUR FIRST JOUST. YOU ARE UP AGINST THE GOLD KNIGHT.
YOUR AIMING POINT(1-8)? 5
YOU MAY USE ONE OF THESE DEFENSES:
        4-STEADY SEAT, 5-SHIELD HIGH, 6-SHIELD LOW.
WHAT IS YOUR CHOICE? 4
HE BROKE HIS LANCE.
YOU BROKE YOUR LANCE(CRACK...)
YOU ARE NOW READY TO TRY AGAIN.
YOUR AIMING POINT(1-8)? 2
YOU MAY USE ONE OF THESE DEFENSES:
        3-LEFT LEAN, 4-STEADY SEAT, 5-SHIELD HIGH, 6-SHIELD LOW.
WHAT IS YOUR CHOICE? 3
HE HIT YOUR SHIELD BUT IT GLANCED OFF.
YOU UNSEATED HIM (LOUD CHEERS AND HUZZAHS!!)
YOU HAVE WON THIS JOUST.

THIS IS YOUR SECOND JOUST. YOUR OPPONENT IS THE SILVER KNIGHT.
YOUR AIMING POINT(1-8)? 3
YOU MAY USE ONE OF THESE DEFENSES:
        1-LOWER HELM, 2-RIGHT LEAN, 3-LEFT LEAN, 4-STEADY SEAT,
        5-SHIELD HIGH, 6-SHIELD LOW.
WHAT IS YOUR CHOICE? 4
HE BROKE HIS LANCE.
YOU INJURED AND UNSEATED YOUR OPPONENT.
YOU HAVE WON THIS JOUST.

YOU ARE DOING WELL! YOUR THIRD JOUST IS AGAINST THE RED KNIGHT.
YOUR AIMING POINT(1-8)? 4
YOU MAY USE ONE OF THESE DEFENSES:
        2-RIGHT LEAN, 4-STEADY SEAT, 5-SHIELD HIGH, 6-SHIELD LOW.
WHAT IS YOUR CHOICE? 4
HE BROKE HIS LANCE.
YOU BROKE YOUR LANCE(CRACK...)
YOU ARE NOW READY TO TRY AGAIN.
YOUR AIMING POINT(1-8)? 4
YOU MAY USE ONE OF THESE DEFENSES:
        2-RIGHT LEAN, 4-STEADY SEAT, 5-SHIELD HIGH, 6-SHIELD LOW.
WHAT IS YOUR CHOICE? 2
HE HIT YOUR SHIELD BU" IT GLANCED OFF.
YOU HIT HIS SHIELD BUT GLANCED OFF.
YOU ARE NOW READY TO TRY AGAIN.
YOUR AIMING POINT(1-8)? 2
YOU MAY USE ONE OF THESE DEFENSES:
        3-LEFT LEAN, 4-STEADY SEAT, 5-SHIELD HIGH, 6-SHIELD LOW.
WHAT IS YOUR CHOICE? 3
HE BROKE HIS LANCE.
YOU MISSED HIM (HISS!)
YOU ARE NOW READY TO TRY AGAIN.
YOUR AIMING POINT(1-8)? 3
YOU MAY USE ONE OF THESE DEFENSES:
        1-LOWER HELM, 2-RIGHT LEAN, 3-LEFT LEAN, 4-STEADY SEAT,
        5-SHIELD HIGH, 6-SHIELD LOW.
WHAT IS YOUR CHOICE? 4
HE BROKE HIS LANCE.
YOU BROKE YOUR LANCE BUT UNSEATED YOUR OPPONENT.
YOU HAVE WON THIS JOUST.

THIS IS YOUR FINAL TEST!! IF YOU WIN THIS ONE THE PRINCESS
IS YOURS!!! THIS FIGHT IS AGAINST THE FIERCE BLACK KNIGHT!!!!
YOUR AIMING POINT(1-8)? 2
YOU MAY USE ONE OF THESE DEFENSES:
        3-LEFT LEAN, 4-STEADY SEAT, 5-SHIELD HIGH, 6-SHIELD LOW.
WHAT IS YOUR CHOICE? 3
HE HAS BROKEN HIS LANCE, INJURED AND UNSEATED YOU (OUCH!)
YOU MISSED HIM (HISS!)
TOO BAD, YOU LOST. HOPE YOUR INSURANCE WAS PAID UP.
SORRY, BETTER LUCK NEXT JOUST.
Ok
```



```
LIST
10      PRINT TAB(24);"JOUST"
20      PRINT TAB(20);"CREATIVE COMPUTING"
30      PRINT TAB(18);"MORRISTOWN, NEW JERSEY"
40      PRINT:PRINT:PRINT
100     INPUT"WHAT IS YOUR NAME, PLEASE";A$
120     PRINT"SIR ";A$;", YOU ARE A MEDIEVAL KNIGHT IN A JOUSTING TOURNAMENT."
121     PRINT"THE PRIZE TO THE WINNER IS THE PRINCESS' HAND IN MARRIAGE."
122     PRINT "TO WIN, YOU MUST BEAT FOUR OTHER KNIGHTS."
123     PRINT "TO JOUST, YOU PICK AN AIMING POINT FOR THE LANCE,"
128     PRINT "AND THEN ONE OF FROM 3 TO 6 DIFFERENT POSSIBLE DEFENSE POSITIONS."
130     PRINT "THE AIMING POINTS ARE:"
150     PRINT "1- HELM"
200     PRINT "2- UPPER LEFT (OF SHIELD)"
250     PRINT "3- UPPER MIDDLE"
300     PRINT "4- UPPER RIGHT"
350     PRINT "5- LOWER LEFT"
400     PRINT "6- LOWER MIDDLE"
450     PRINT "7- LOWER RIGHT"
500     PRINT "8- BASE OF SHIELD"
520     PRINT
530     PRINT "IF YOU BREAK A LANCE OR LOSE A HELM, YOU WILL BE GIVEN ANOTHER."
550     PRINT "GOOD LUCK, SIR!"
555     PRINT
600     FOR A = 1 TO 4
650     ON A GOTO 800, 950, 1100, 1250
700     REM OFF YOU GO TO THE FOUR JOUSTS.
750     REM ------------------------------
800     PRINT "THIS IS YOUR FIRST JOUST. YOU ARE UP AGINST THE GOLD KNIGHT."
850     GOTO 1400
950     PRINT "THIS IS YOUR SECOND JOUST. YOUR OPPONENT IS THE SILVER KNIGHT."
1000    GOTO 1400
1100    PRINT "YOU ARE DOING WELL! YOUR THIRD JOUST IS AGAINST THE RED KNIGHT."
1150    GOTO 1400
1250    PRINT "THIS IS YOUR FINAL TEST!! IF YOU WIN THIS ONE THE PRINCESS"
1270    PRINT "IS YOURS!!! THIS FIGHT IS AGAINST THE FIERCE BLACK KNIGHT!!!!"
1400    INPUT "YOUR AIMING POINT(1-8)";B
1450    IF B <1 OR B>8 THEN 1400
1470    PRINT "YOU MAY USE ONE OF THESE DEFENSES:"
1500    ON B GOTO 1550, 1650, 1750, 1850, 1550, 1750, 1550, 1750
1538    PRINT " 4-STEADY SEAT, 5-SHIELD HIGH, 6-SHIELD LOW."
1600    GOTO 2000
1650    PRINT " 3-LEFT LEAN, 4-STEADY SEAT, 5-SHIELD HIGH, 6-SHIELD LOW."
1700    GOTO 2000
1750    PRINT " 1-LOWER HELM, 2-RIGHT LEAN, 3-LEFT LEAN, 4-STEADY SEAT, "
1755    PRINT " 5-SHIELD HIGH, 6-SHIELD LOW."
1800    GOTO 2000
1850    PRINT " 2-RIGHT LEAN, 4-STEADY SEAT, 5-SHIELD HIGH, 6-SHIELD LOW."
1900    GOTO 2000
1950    PRINT " 1-LOWER HELM, 4-STEADY SEAT, 5-SHIELD HIGH, 6-SHIELD LOW."
2000    INPUT "WHAT IS YOUR CHOICE"; C
2050    D = INT(RND(1)*8) + 1
2100    ON D GOTO 2150, 2200, 2250, 2300, 2350, 2400, 2450, 2500
2150    ON C GOTO 2600, 2600, 2600, 2700, 2800, 2600
2200    ON C GOTO 2800, 2750, 2600, 2750, 2750, 2600
2250    ON C GOTO 2850, 2800, 2650, 2750, 2950, 2900
2300    ON C GOTO 2650, 2600, 2750, 2650, 2650, 2800
2350    ON C GOTO 2750, 2950, 2600, 2750, 2600, 2750
2400    ON C GOTO 2950, 2650, 2750, 2950, 2850, 2750
2450    ON C GOTO 2650, 2600, 2950, 2650, 2650, 2650
2500    ON C GOTO 2750, 2650, 2850, 2750, 2850, 2750
2600    PRINT "HE MISSED YOU!":S=0:GOTO 3000
2650    PRINT "HE HIT YOUR SHIELD BUT IT GLANCED OFF.":S=0:GOTO 3000
2700    PRINT "HE KNOCKED OFF YOUR HELM!":S=0:GOTO 3000
2750    PRINT "HE BROKE HIS LANCE.":S=0:GOTO 3000
2800    PRINT "HE HAS UNSEATED YOU(THUD!)":S=5:GOTO 3000
2850    PRINT "HE HAS BROKEN HIS LANCE, INJURED AND UNSEATED YOU (OUCH!)"
2855    S=5:GOTO 3000
2900    PRINT "HE HAS INJURED AND UNSEATED YOU (CRASH!)":S=5:GOTO 3000
2950    PRINT "HE HAS BROKEN HIS LANCE AND UNSEATED YOU (CLANG!)":S=5
3000    E = INT(RND(1)*6) + 1
3050    ON D GOTO 3100,3150,3200,3250,3100,3200,3100,3300
3100    IF E<4 THEN 3000 ELSE 3350
3150    IF E<3 THEN 3000 ELSE 3350
3200    GOTO 3350
3250    IF E=1 OR E=3 THEN 3000 ELSE 3350
3300    IF E = 2 OR E = 3 THEN 3000
3350    ON E GOTO 3400, 3450, 3500, 3550, 3600, 3650
3400    ON B GOTO 3700, 3900, 3950, 3750, 3850, 4050, 3750, 3850
3450    ON B GOTO 3700, 3850, 3900, 3700, 4050, 3750, 3700, 3750
3500    ON B GOTO 3700, 3700, 3750, 3850, 3700, 3850, 4050, 3900
3550    ON B GOTO 3800, 3850, 3850, 3750, 3850, 4050, 3750, 3850
3600    ON B GOTO 3900, 3850, 4050, 3750, 3700, 3950, 3750, 3950
3650    ON B GOTO 3700, 3700, 4000, 3900, 3850, 3850, 3750, 3850
3700    PRINT "YOU MISSED HIM (HISS!)":T=0:GOTO 4100
3750    PRINT "YOU HIT HIS SHIELD BUT GLANCED OFF.":T=0:GOTO 4100
3800    PRINT "YOU KNOCKED OFF HIS HELM!(CHEERS!)":T=0:GOTO 4100
3850    PRINT "YOU BROKE YOUR LANCE(CRACK...)":T=0:GOTO 4100
3900    PRINT "YOU UNSEATED HIM (LOUD CHEERS AND HUZZAHS!!)":T=5:GOTO 4100
3950    PRINT "YOU BROKE YOUR LANCE, BUT UNSEATED AND INJURED YOUR FOE."
3955    T=5:GOTO 4100
4000    PRINT "YOU INJURED AND UNSEATED YOUR OPPONENT.":T=5:GOTO 4100
4050    PRINT "YOU BROKE YOUR LANCE BUT UNSEATED YOUR OPPONENT.":T=5:GOTO 4100
4100    IF S = T AND S = 0 THEN 4450
4150    IF S = T GOTO 4400
4200    IF S<T GOTO 4300
4250    IF S>T GOTO 4350
4300    PRINT "YOU HAVE WON THIS JOUST.":PRINT:GOTO 4320
4320    NEXT A
4330    GOTO 4550
4350    PRINT "TOO BAD, YOU LOST. HOPE YOUR INSURANCE WAS PAID UP.":GOTO 4500
4400    PRINT "TOO BAD, YOU BOTH LOST. AT LEAST YOUR HONOR IS INTACT.":GOTO 4500
4450    PRINT "YOU ARE NOW READY TO TRY AGAIN.":GOTO 1400
4500    PRINT "SORRY, BETTER LUCK NEXT JOUST.":GOTO 9999
4550    PRINT "HOORAY! YOU ARE THE WINNER. HERE COMES THE BRIDE!"
9999    END
Ok
```

Puzzle

by Leor Zolman

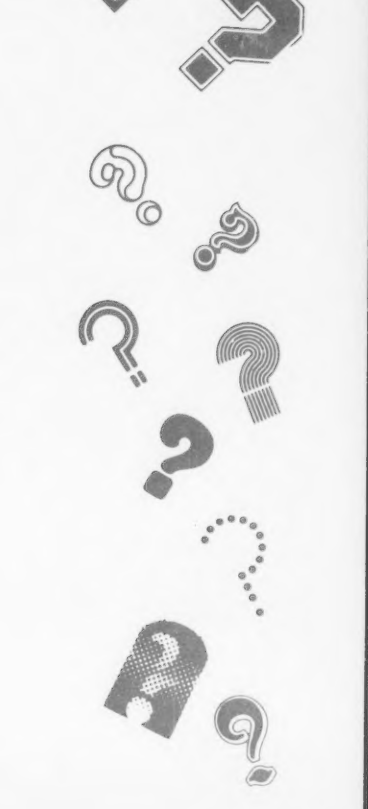
This program creates word search puzzles. These are puzzles in which words are embedded in a matrix of random letters. The object is to find all the words, which may be read right, left, up, down or diagonally. PUZZLE allows you to enter a set of words and then uses these to form a word search puzzle. If the computer decides that it can't fit all your words into the puzzle, it will ask if you want to start over.

Over the course of several years, we've received quite a few word-puzzle programs, but we feel that this is the best we've tried. If you enjoy programs of this kind, you might want to try writing a program which solves word puzzles — you enter the array of letters, and tell the computer what words to search for (though somehow this doesn't sound quite as much fun to play). ■

```
RUN

  THIS PROGRAM IS A WORD SEARCH PUZZLE GENERATOR!!
THE PROGRAM TAKES A SET OF INPUT STRINGS, PURGES ALL
NON-ALPHABETIC CHARACTERS OUT OF THEM, AND INCORPORATES
THEM INTO A WORD SEARCH PUZZLE.

  IN THE COURSE OF MAKING THE PUZZLE, THE MACHINE MAY
FIND THAT IT CAN'T PUT A PARTICULAR WORD ANYWHERE, AND
SO WILL ASK YOU IF IT SHOULD START THE WHOLE PUZZLE
OVER.  IF YOU DON'T WANT IT TO START OVER, TYPING 'NO'
WILL THROW AWAY THAT PARTICULAR WORD.  IF THIS PERSISTS,
TRY EITHER GIVING LESS WORDS OR BIGGER PUZZLE DIMENSIONS!

HOW MANY COLUMNS DOES YOUR PRINTER HAVE? 72
DO YOU WANT A SOLUTION PRINTOUT? YES
WHAT IS TO BE THE WIDTH OF THE PUZZLE? 15
THE LENGTH? 15
WHAT IS THE MAXIMUM NUMBER OF WORDS IN THE PUZZLE? 10

NOW ENTER A HEADING THAT WILL BE PRINTED OVER THE PUZZLE:
( 72 CHARACTERS MAXIMUM! )
? COMPUTER LANGUAGES
OK . . . ENTER A WORD AT EACH QUESTION MARK.
TO REDO THE PREVIOUS WORD, TYPE A HYPHEN (-).
WHEN YOU RUN OUT OF WORDS, TYPE A PERIOD (.).
? BAS#á^Z$  IC
-basic-
? FOR)(+&TRAN
-fortran-
? P L I
-pli-
? C O B O L++=';
-cobol-
? ASSEMBNLER
-assembnler-
? -
REDO assembnler.
? ASSEMBLER
-assembler-
? RPG
-rpg-
? ALGOL
-algol-
? LISP
-lisp-
? SNOBOL
-snobol-
? PILOT
-pilot-
THAT'S IT... 10 WORDS.
NOW LET ME PONDER THIS.....
HOW MANY COPIES OF THIS PUZZLE DO YOU WANT? 1
FOR EACH COPY, HIT RETURN TO BEGIN PRINTING...
?
```

```
COMPUTER LANGUAGES

B I U R W I X N R S K A T T Z
O G Q M L G S L R E P A Q Y S
Y V Y P F F A Z O I Z K C F P
P M T T R H P P L G O S S S Y
Z S R I H B S O J Y L N B X X
E A C E K R T H S I Q A H F N
D F Q I L U K K Q B B F B R J
D L Q T S B V A Q H W W F G C
Q I L Y D A H L K U P Q V P A
K X P Q G Z B E X M R R F U D
H V C S B P S Y S T I L X S U
I I I D I D R G R S V A Y T Y
E H N D A L C A N U A Z W J K
L A C R Y L H V K T F Z Q W C
F V Q Y U A J F U G P Q J B V

FIND THESE HIDDEN WORDS IN THE ABOVE PUZZLE:

algol          assembler      basic          cobol          fortran
lisp           pilot          pli            rpg            snobol
```

```
HERE IS THE ANSWER KEY:

. . . . . I . . . . . . . .
. . . . L . . L . . P . . . .
. . . P . . . . O I . . . . .
. . . . . . . . L G . . S . .
. . R . . . . O . . L N . . .
. . C E . . T . . . O A . . .
. . . I L . . . . B . . . . .
. . . . S B . . O . . . F . .
. . L . . A N L . . . O . . .
. . P Q G . B E . . R . . . .
. . . S B P . . S T . . . . .
. . . . I O R . R S . . . . .
. . . . . L C A . . A . . . .
. . . . . N . . . . . . . . .
. . . . . . . . . . . . . . .

FIND THESE HIDDEN WORDS IN THE ABOVE PUZZLE:

algol          assembler      basic          cobol          fortran
lisp           pilot          pli            rpg            snobol
```



```
Ok

LIST
10 PRINT TAB(26);"PUZZLE"
20 PRINT TAB(20);"CREATIVE COMPUTING"
30 PRINT TAB(18);"MORRISTOWN, NEW JERSEY"
40 PRINT:PRINT:PRINT
50 PRINT "  THIS PROGRAM IS A WORD SEARCH PUZZLE GENERATOR!!"
60 PRINT "THE PROGRAM TAKES A SET OF INPUT STRINGS, PURGES ALL"
70 PRINT "NON-ALPHABETIC CHARACTERS OUT OF THEM, AND INCORPORATES"
80 PRINT "THEM INTO A WORD SEARCH PUZZLE."
90 PRINT
100 PRINT "  IN THE COURSE OF MAKING THE PUZZLE, THE MACHINE MAY"
110 PRINT "FIND THAT IT CAN'T PUT A PARTICULAR WORD ANYWHERE, AND"
120 PRINT "SO WILL ASK YOU IF IT SHOULD START THE WHOLE PUZZLE"
130 PRINT "OVER.  IF YOU DON'T WANT IT TO START OVER, TYPING 'NO'"
140 PRINT "WILL THROW AWAY THAT PARTICULAR WORD.  IF THIS PERSISTS,"
```

Leor Zolman, 362 Memorial Drive, Cambridge, MA 02139.

```
150 PRINT "TRY EITHER GIVING LESS WORDS OR BIGGER PUZZLE DIMENSIONS!"
160 PRINT:PRINT
280 CLEAR 3000
300 DEF FNA(Z)=INT(RND(1)*Z+1)
310 INPUT "HOW MANY COLUMNS DOES YOUR PRINTER HAVE";TW
320 INPUT "DO YOU WANT A SOLUTION PRINTOUT";X$
330 INPUT "WHAT IS TO BE THE WIDTH OF THE PUZZLE";W:MD=W
340 IF W=2<=TW THEN 345
343 PRINT "THAT WILL NOT FIT IN";TW;" COLUMNS.":GOTO 330
345 IF W<1 THEN 330
350 INPUT "THE LENGTH";L:IF L>W THEN MD=L
355 IF L<1 THEN 350
360 INPUT "WHAT IS THE MAXIMUM NUMBER OF WORDS IN THE PUZZLE";M
370 IF M>=2 THEN 380
375 PRINT "SORY; THERE MUST BE AT LEAST 2 WORDS.":GOTO 360
380 PRINT
390 DIM A$(L,W),W$(M)
400 DIM W(M,3),DXY(8,2),DD(28)
410 PRINT "NOW ENTER A HEADING THAT WILL BE PRINTED OVER THE PUZZLE:"
420 PRINT "(";TW;"CHARACTERS MAXIMUM! )"
430 INPUT XY$
440 PRINT "OK . . . ENTER A WORD AT EACH QUESTION MARK."
450 PRINT "TO REDO THE PREVIOUS WORD, TYPE A HYPHEN (-)."
460 PRINT "WHEN YOU RUN OUT OF WORDS, TYPE A PERIOD (.)."
470 FOR I=1 TO M
480 INPUT T$:IF T$="-" THENI=I-1:PRINT "REDO ";W$(I);". . .":GOTO 480
490 IF T$="." THEN M=I-1:GOTO 660
500 IF LEN(T$)=0 THEN PRINT "INPUT ERROR; REDO:":GOTO 480
510 J=1
520 TE$=MID$(T$,J,1):IF TE$>="a" AND TE$<="z" THEN   570
525 IF TE$<"A" OR TE$>"Z" THEN 530
527 MID$(T$,J,1)=CHR$(ASC(MID$(T$,J,1))+32):GOTO 570
530 IF TE$=T$ THEN T$="": GOTO 500
540 IF J=LEN(T$) THEN T$=LEFT$(T$,J-1):GOTO 580
550 IF J=1 THEN T$=RIGHT$(T$,LEN(T$)-1):J=J-1:GOTO 570
560 T$=LEFT$(T$,J-1)+RIGHT$(T$,LEN(T$)-J):J=J-1
570 J=J+1:IF J<=LEN(T$) THEN 520
580 PRINT "-";T$;"-"
600 IF LEN(T$)<=MD THEN 610
605 PRINT "THAT'S TOO LONG, I'M AFRAID.";
607 PRINT " TRY ANOTHER ONE:":GOTO 480
610 FOR IZ=1 TO I-1: IF W$(IZ)<>T$ THEN NEXT:GOTO 630
620 PRINT "YOU ENTERED THAT ONE ALREADY. TRY ANOTHER:":GOTO 480
630 W$(I)=T$
640 NEXT I
650 PRINT "THAT'S IT...";M;"WORDS."
660 PRINT "NOW LET ME PONDER THIS....."
680 FOR I=1 TO M-1
685 FOR J=I+1 TO M
690 IF LEN(W$(I)) < LEN(W$(J)) THEN HZ$=W$(I):W$(I)=W$(J):W$(J)=HZ$
700 NEXT:NEXT
710 FOR I=1 TO 8:READ DXY(I,1),DXY(I,2):NEXT
720 FOR I=1 TO 28:READ DD(I):NEXT
730 DATA 0,1,1,1,1,0,1,-1,0,-1,-1,-1,-1,0,-1,1
740 DATA 2,4,6,8,2,4,6,8,2,4,6,8,2,4,6,8,2,4,6,8,2,4,6,8,1,3,5,7
750 FOR I=1 TO M
760 LN=LEN(W$(I))
770 MT=0
790 SD=DD(FNA(28))
800 SX=FNA(W):X1=SX+(LN-1)*DXY(SD,1):IF X1<1 OR X1>W THEN 790
810 SY=FNA(L):X1=SY+(LN-1)*DXY(SD,2):IF X1<1 OR X1>L THEN 790
820 MT=MT+1:IF MT<>W*L*2 THEN 850
830 PRINT "COULDN'T FIT  '";W$(I);"'  IN THE PUZZLE."
832 INPUT "DO YOU WANT ME TO START OVER";A$
834 IF LEFT$(A$,1)="y" THEN 750
836 W$(I)="":GOTO 950
850 J=SY:K=SX
860 FOR P=1 TO LN
870 IF LEN(A$(J,K)) AND A$(J,K)<>MID$(W$(I),P,1) THEN 790
880 J=J+DXY(SD,2):K=K+DXY(SD,1):NEXT P
900 J=SY:K=SX
910 FOR P=1 TO LN:A$(J,K)=MID$(W$(I),P,1)
920 J=J+DXY(SD,2):K=K+DXY(SD,1):NEXT
940 W(I,1)=SX:W(I,2)=SY:W(I,3)=SD
950 NEXT I
970 FOR I=1 TO L
975 FOR J=1 TO W
980 IF A$(I,J)="" THEN A$(I,J)=CHR$(FNA(26)+96)
990 NEXT:NEXT
1010 FOR I=1 TO M-1:FOR J=I+1 TO M
1020 IF W$(I)<=W$(J) THEN 1030
1021 HZ$=W$(I):W$(I)=W$(J):W$(J)=HZ$
1025 FOR K=1 TO 3:HZ=W(I,K):W(I,K)=W(J,K):W(J,K)=HZ:NEXT K
1030 NEXTJ:NEXT I
1040 INPUT "HOW MANY COPIES OF THIS PUZZLE DO YOU WANT";N
1050 PRINT "FOR EACH COPY, HIT RETURN TO BEGIN PRINTING..."
1060 FOR C=1 TO N:GOSUB 1070:NEXT:GOTO 1230
1070 INPUT A$:PRINT
1080 T=(TW-2*W)/2:PRINT
1090 PRINT
1100 PRINT TAB((TW-LEN(XY$))/2);XY$
1110 PRINT:PRINT
1120 FOR J=1 TO L:PRINT TAB(T);
1130 FOR K=1 TO W:IF A$(J,K)="." THEN PRINT ". ";:GOTO 1140
1135 PRINT CHR$(ASC(A$(J,K))-32);" ";
1140 NEXT:PRINT:NEXT
1150 PRINT:PRINT
1160 PRINT "FIND THESE HIDDEN WORDS IN THE ABOVE PUZZLE:"
1170 PRINT
1180 FOR J=1 TO M:IF LEN(W$(J))=0 THEN 1210
1190 IF POS(0) + LEN(W$(J)) > TW-2 THEN PRINT
1200 PRINT W$(J),
1210 NEXT:PRINT:PRINT:PRINT:PRINT
1220 RETURN
1230 IF LEFT$(X$,1)="Y" OR  EFT$(X$,1)="y" THEN 1250
1240 END
1250 REM
1260 FOR I=1 TO L:FOR J=1 TO W:A$(I,J)=".":NEXTJ:NEXTI
1270 FOR I=1 TO M
1280 LN=LEN(W$(I)):J=W(I,2):K=W(I,1)
1290 FOR P=1 TO LN
1300 A$(J,K)=MID$(W$(I),P,1)
1310 J=J+DXY(W(I,3),2):K=K+DXY(W(I,3),1):NEXT P
1320 NEXT I
1330 XT$="HERE IS THE ANSWER KEY:"
1340 GOSUB 1070
1350 PRINT:PRINT
1360 END
Ok
```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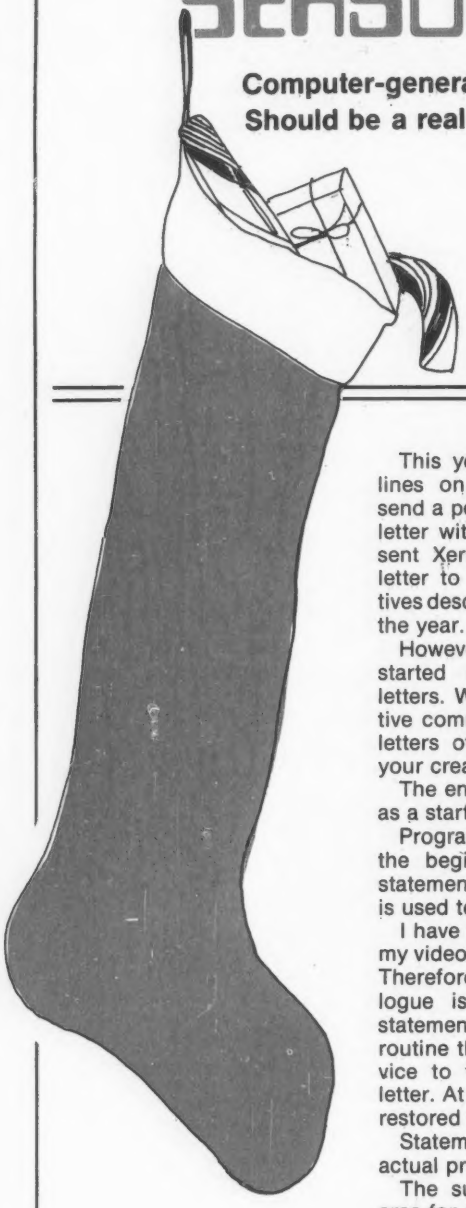
SEASON'S GREETINGS!

Computer-generated Christmas letters to friends and relatives. Should be a real hit this holiday season.



Gordon Flemming

This year instead of writing a few lines on selected Christmas cards, send a personalized computer written letter with each card. In the past we sent Xerox copies of a handwritten letter to our close friends and relatives describing our family activities for the year.

However, three years ago we started sending computer printed letters. We have received many positive comments about the letters. The letters offer a good opportunity for your creative urge.

The enclosed program can be used as a starting point.

Program steps 110 through 210 are the beginning dialogue. The input statements obtain the information that is used to personalize each letter.

I have my BASIC configured to use my video terminal as a console device. Therefore, all of the beginning dialogue is on the screen. Then, at statement 220, I branch to a subroutine that switches the console device to the printer for printing the letter. At statement 290 the console is restored to the video terminal.

Statements 230 through 280 do the actual printing of the letter.

The subroutine at 1000 offers an area for creativity. This is the heading portion of the letter. If you can spend the programming time some beautiful Teletype pictures can be designed. The amateur radion Teletype enthusiast send some very unusual pictures back and forth every holiday season.

We change our heading picture every year. However, my favorite is the one shown. I first saw it in "The Best of Creative Computing."

Subroutines at 4000 and 6000 contain the letters from the wife and the husband. These routines are where the strings obtained in the initial dialogue can be used to personalize each letter.

The subroutine at 2000 contains a calander for next year. Some clever programs have been written to automatically generate a calander. However, in the interest of saving programming time, I just use print statements to print the calander line-by-line. If you are typing this calander, you will find it easier to type the month statements first. Then type the date portions in order. This will make it easier to keep the numbers justified.

I am sure the reader will think of ways to change the program (don't we always?). To stimulate your thinking, here are a few ideas.

Add a letter to the children. This letter could be written by your own children. Add a test question to print or not print in the initial dialogue along with a GOSUB to the routine. A simple picture of a snowman goes well here if you don't want a regular letter.

You may have personal news that is of interest to family but not to most friends. So, write a family section and test whether to print or not.

Change the string used in the LOVE picture (line 1060) to incorporate the persons' names or city or add an input statement to obtain a personal string to be used in the picture.

If you come up with some good pictures, submit them for publication and we can all have something new to work with next year.

Have a Merry Christmas and a Happy New Year. ■

Gordon Flemming, 13490 Simshaw Ave., Sylmar CA 91342.

```
LIST

50 PRINT"1978 CHRISTMAS LETTER PROGRAM"
75 CLEAR 500
100 DIM A$(30),T$(120),L$(20),F$(30),C$(20),K$(30)
110 INPUT"LAST NAME";L$
120 INPUT"FIRST NAMES";F$
130 INPUT"THEIR CITY OR STATE";C$
140 PRINT"CHILDRENS NAMES OR"
145 INPUT"TYPE 'NONE'";K$
150 IF K$="NONE" THEN K$=" "
160 INPUT"PRINT HEADING (Y OR N)";H$
170 INPUT"PRINT CALENDAR (Y OR N)";CA$
180 INPUT"PRINT BOTH LETTERS (Y OR N)";B$
190 IF B$="Y" THEN 220
200 INPUT"PRINT WIFE'S LETTER (Y OR N)";W$
210 INPUT"PRINT HUSBAND'S LETTER (Y OR N)";HU$
215 REM
216 REM MAIN LINE OF PROGRAM
217 REM
220 GOSUB 8000:REM ROUTINE TO CHANGE PORTS TO PRINTER
230 PRINT:PRINT:PRINT
240 IF H$="Y" THEN GOSUB 1000:REM PRINT HEADING
245 RESTORE
250 IF W$="Y" OR B$="Y" THEN GOSUB 4000:REM PRINT WIFE'S LETTER
260 IF HU$="Y" OR B$="Y" THEN GOSUB 6000:REM PRINT HUSBAND'S LETTER
270 IF CA$="Y" THEN GOSUB 2000:REM PRINT CALENDAR
280 PRINT:PRINT:PRINT
290 GOSUB 9000:REM CHANGE PORTS BACK TO VIDEO TERMINAL
299 GOTO 110
999 REM
1000 REM HEADING PICTURE
1001 REM
1060 A$="MERRYCHRISTMASFROMTHEFLEMMINGS"
1065 L=LEN(A$)
1100 FOR J=0 TO INT(60/L)
1110 FOR I=1 TO L
1120 T$(J*L+I)=MID$(A$,I,1)
1130 NEXT I: NEXT J
1140 C=0
1200 A1=1:P=1:C=C+1:IF C=37 THEN 1715
1205 PRINT
1210 READ A:A1=A1+A:IF P=1 THEN 1300
1240 FOR I =1 TO A
1250 PRINT" ";
1255 NEXT I
1260 P=1
1270 GOTO 1400
1300 FOR I= A1-A TO A1-1
1310 PRINT T$(I);
1315 NEXT I
1320 P=0
1400 IF A1>60 THEN 1200
1410 IF A1<=60 THEN 1210
1600 DATA 60,1,12,26,9,12,3,8,24,17,8,4,6,23,21,6,4,6,22,12,5,6,5
1610 DATA 4,6,21,11,9,6,4,4,6,21,13,13,5,4,4,6,21,9,11,5,4
1620 DATA 4,6,21,8,11,6,4,4,6,21,7,11,7,4,4,6,21,6,11,8,4
1630 DATA 4,6,19,1,1,5,11,9,4,4,6,19,1,1,5,13,13,4,4,6,18,9,1,6,8,11,4
1640 DATA 4,6,17,3,1,7,5,13,4,4,6,15,5,9,23,5,1,29,5,17,8
1650 DATA 1,29,9,9,13,1,13,5,40,1,1,13,5,40,1,4,6,13,3,13,6,12,5,1
1660 DATA 5,6,11,3,11,6,14,3,1,5,6,11,3,11,6,15,3,1
1670 DATA 6,6,9,3,10,6,16,1,1,6,6,9,3,13,6,7,1,10
1680 DATA 7,6,7,3,13,6,6,3,13,7,6,7,3,13,14,13,8,6,5,3,14,6,6,5,10
1690 DATA 8,6,5,3,14,6,7,1,10,9,6,3,3,15,6,16,1,1
1700 DATA 9,6,3,3,15,6,15,2,1,10,6,1,3,16,6,14,3,1,10,10,16,6,13,5,1
1710 DATA 11,8,13,27,1,11,8,13,27,1,60
1715 PRINT:PRINT:PRINT
1720 RETURN
1999 REM
2000 REM 1979 CALENDAR
2001 REM
2010 PRINT:PRINT:PRINT:PRINT
2015 T=24
2020 PRINTTAB(T);
2030 PRINT"1    9999    7777    9999"
2040 PRINTTAB(T);
2050 PRINT"1    9  9       7     9  9"
2060 PRINTTAB(T);
2070 PRINT"1    9999       7     9999"
2080 PRINTTAB(T);
2090 PRINT"1       9       7        9"
2100 PRINTTAB(T);
2110 PRINT"1    9999       7     9999"
2120 PRINT:PRINT:PRINT:PRINT
2200 PRINT"          JANUARY                FEBRUARY                MARCH"
2205 PRINT
2210 PRINT"    ** 1  2  3  4  5  6    ** ** ** ** 1  2  3";
2215 PRINT"    ** ** ** ** 1  2  3"
2220 PRINT"     7  8  9 10 11 12 13     4  5  6  7  8  9 10";
2225 PRINT"     4  5  6  7  8  9 10"
2230 PRINT"    14 15 16 17 18 19 20    11 12 13 14 15 16 17";
2240 PRINT"    11 12 13 14 15 16 17"
2250 PRINT"    21 22 23 24 25 26 27    18 19 20 21 22 23 24";
2260 PRINT"    18 19 20 21 22 23 24"
2270 PRINT"    28 29 30 31 ** ** **    25 26 27 28 ** ** **";
2280 PRINT"    25 26 27 28 29 30 31"
2285 PRINT:PRINT
2300 PRINT"          APRIL                  MAY                    JUNE"
2305 PRINT
2310 PRINT"     1  2  3  4  5  6  7    ** **  1  2  3  4  5";
2320 PRINT"    ** ** ** ** ** **  1  2"
2330 PRINT"     8  9 10 11 12 13 14     6  7  8  9 10 11 12";
2340 PRINT"     3  4  5  6  7  8  9"
2350 PRINT"    15 16 17 18 19 20 21    13 14 15 16 17 18 19";
2360 PRINT"    10 11 12 13 14 15 16"
2370 PRINT"    22 23 24 25 26 27 28    20 21 22 23 24 25 26";
2380 PRINT"    17 18 19 20 21 22 23"
2390 PRINT"    29 30 ** ** ** ** **    27 28 29 30 31 ** **";
2395 PRINT"    24 25 26 27 28 29 30"
2398 PRINT:PRINT
2400 PRINT"          JULY                   AUGUST                 ";
2401 PRINT"SEPTEMBER"
2405 PRINT
2410 PRINT"     1  2  3  4  5  6  7    ** ** **  1  2  3  4";
2420 PRINT"    ** ** ** ** ** **  1"
```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Each title $9.50 plus $1.00 shipping
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[[CP/M USERS]]

JOIN OUR "BEST PROGRAM" OF THE MONTH CLUB AND GET A CHANCE TO WIN $100.00 (EACH FOR APPLE & CPM) EVERY OTHER MONTH

+

A CHANCE TO SEE YOUR NAME IN THIS COLUMN.

"BEST PROGRAM" SUBMITTED IN THE MONTH OF [MONTH NAME]
BY

APPLE II "YOUR NAME / CITY / STATE " TITLED
" TITLE "

CP/M "YOUR NAME / CITY / STATE " TITLED
" TITLE "

RULES:
1. $100.00 PRIZE EACH (1 FOR APPLE AND 1 FOR CP/M) TO THE PERSON WHO SUBMITS THE BEST ORIGINAL PROGRAM.
2. EVERYONE WHO SUBMITS A PROGRAM RECEIVES HIS/HER DISK/TAPE BACK WITH 10 (FOR DISK) OR 5 (OR LESS) FOR TAPE USERS.
3. ALL PROGRAMS MUST BE SUBMITTED ON DISK OR TAPE AND BE WELL COMMENTED AND EXECUTABLE.
   THE PROGRAM MUST INCLUDE SOURCE AS WELL AS INT/COM (CP/M).
4. INCLUDE YOUR NAME / ADDRESS / PHONE NUMBER.
5. SEND A SELF ADDRESSED STAMPED ENVELOPE IF YOU WISH TO RECEIVE YOUR DISK/TAPE BACK.
6. CUT OFF DATE IS THE LAST DAY OF EVERY EVEN NUMBERED MONTH.

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1619 HAWTHORNE BLVD.
LAWNDALE, CA 90260 213 371-4010
11:30 A.M. TO 7:30 P.M.

CIRCLE 159 ON READER SERVICE CARD

```
2430 PRINT"    8  9 10 11 12 13 14    5  6  7  8  9 10 11";
2440 PRINT"    2  3  4  5  6  7  8"
2450 PRINT"   15 16 17 18 19 20 21   12 13 14 15 16 17 18";
2460 PRINT"    9 10 11 12 13 14 15"
2470 PRINT"   22 23 24 25 26 27 28   19 20 21 22 23 24 25";
2480 PRINT"   16 17 18 19 20 21 22"
2490 PRINT"   29 30 31 .. .. .. ..   26 27 28 29 30 31 ..";
2495 PRINT"   23 24 25 26 27 28 29"
2497 PRINT"   .. .. .. .. .. .. ..   .. .. .. .. .. .. ..";
2498 PRINT"   30 .. .. .. .. .. .."
2499 PRINT:PRINT
2500 PRINT"            OCTOBER                    NOVEMBER                ";
2501 PRINT"DECEMBER"
2505 PRINT
2510 PRINT"   .. 1  2  3  4  5  6   .. .. .. .. 1  2  3";
2515 PRINT"   .. .. .. .. .. .. 1"
2520 PRINT"    7  8  9 10 11 12 13    4  5  6  7  8  9 10";
2525 PRINT"    2  3  4  5  6  7  8"
2530 PRINT"   14 15 16 17 18 19 20   11 12 13 14 15 16 17";
2535 PRINT"    9 10 11 12 13 14 15"
2540 PRINT"   21 22 23 24 25 26 27   18 19 20 21 22 23 24";
2545 PRINT"   16 17 18 19 20 21 22"
2550 PRINT"   28 29 30 31 .. .. ..   25 26 27 28 29 30 ..";
2555 PRINT"   23 24 25 26 27 28 29"
2560 PRINT"   .. .. .. .. .. .. ..   .. .. .. .. .. .. ..";
2565 PRINT"   30 31 .. .. .. .. .."
2600 PRINT:PRINT:PRINT
2999 RETURN
3999 REM
4000 REM WIFE'S LETTER
4001 REM
4010 PRINT"HELLO "F$":"
4020 PRINT
4030 PRINT"   HERE WE ARE AGAIN WITH OUR ANNUAL SAGA."
4040 PRINT"   WE HOPE ALL IS WELL THERE IN "C$"."
4050 IF K$="" THEN 4090
4060 PRINT"   "K$" ARE YOU GETTING READY FOR"
4070 PRINT"CHRISTMAS?  BRUCE AND BRIAN ARE EXCITED ABOUT"
4080 PRINT"THE HOLIDAYS."
4090 PRINT"."
4100 PRINT"."
4110 PRINT"."
4200 PRINTTAB(50)"SO LONG FOR NOW,"
5998 RETURN
5999 REM
6000 REM HUSBAND'S LETTER
6001 REM
6005 PRINT:PRINT
6010 PRINT"GREETINGS TO THE "L$"'S,"
6020 PRINT"   WELL MY COMPUTER AND I GOT TOGETHER AGAIN"
6030 PRINT"THIS YEAR.  THIS IS BECOMING A TRADITION (AND"
6040 PRINT"A VERY ENJOYABLE ONE)."
6050 PRINT"."
6060 PRINT"."
6070 PRINT"."
6080 PRINT"HAPPY HOLIDAYS,"F$
6090 IF K$="" THEN 7999
6100 PRINT"AND "K$
7999 RETURN
8000 REM ROUTINE USING POKE STATEMENTS TO CHANGE THE
8001 REM OUTPUT PORT FROM THE VIDEO TERMINAL TO
8002 REM A PRINTER OR TELETYPE
8999 RETURN
9000 REM ROUTINE USING POKE STATEMENTS TO CHANGE THE
9001 REM OUTPUT PORT FROM A PRINTER OR TELETYPE TO THE
9002 REM VIDEO TERMINAL
9999 RETURN
OK
```

```
RUN
1978 CHRISTMAS LETTER PROGRAM
LAST NAME? SMITH
FIRST NAMES? JOHN AND MARY
THEIR CITY OR STATE? DENVER
CHILDRENS NAMES OR
TYPE 'NONE'? NONE
PRINT HEADING (Y OR N)? Y
PRINT CALENDAR (Y OR N)? Y
PRINT BOTH LETTERS (Y OR N)? Y


MERRYCHRISTMASFROMTHEFLEMMINGSMERRYCHRISTMASFROMTHEFLEMMINGS
M           SFROMTHEFLEMMINGSMERRYCHRI          THEFLEMMINGS
MER        MASFROMTHEFLEMMINGSMERRY               LEMMINGS
MERR       TMASFROMTHEFLEMMINGSMER                  MMINGS
MERR       TMASFROMTHEFLEMMINGSME                FROMT      MINGS
MERR       TMASFROMTHEFLEMMINGSM              ASFROMTH       INGS
MERR       TMASFROMTHEFLEMMINGSM             MASFROMTHE      INGS
MERR       TMASFROMTHEFLEMMINGSM            TMASFROMTHE      INGS
MERR       TMASFROMTHEFLEMMINGSM           STMASFROMTH       INGS
MERR       TMASFROMTHEFLEMMINGSM          ISTMASFROMT        INGS
MERR       TMASFROMTHEFLEMMINGSM        RISTMASFROM          INGS
MERR       TMASFROMTHEFLEMMING M      HRISTMASFRO            INGS
MERR       TMASFROMTHEFLEMMIN  M     HRISTMASFR              INGS
MERR       TMASFROMTHEFLEMMI   M      RISTMASF               INGS
MERR       TMASFROMTHEFLEM     M       ISTMA                 INGS
MERR       TMASFROMTHEFLEM        ME                        MINGS
M                                 MERRY                  LEMMINGS
M                                 MERRYCHRI           THEFLEMMINGS
M             FROMT                                          S
M             FROMT                                          S
MERR       TMASFROMTHEFL    INGSMERRYC       ASFROMTHEFLE     S
MERRY       MASFROMTHEF    MINGSMERRYC       ASFROMTHEFLEMM   S
MERRY       MASFROMTHEF    MINGSMERRYC       ASFROMTHEFLEMMI  S
MERRYC      ASFROMTHE     MMINGSMERRYC       ASFROMTHEFLEMMIN S
MERRYC      ASFROMTHE     MMINGSMERRYC       ASFROMT EFLEMMINGS
MERRYCH      SFROMTH     EMMINGSMERRYC       ASFROM  EFLEMMINGS
MERRYCH      SFROMTH     EMMINGSMERRYC              EFLEMMINGS
MERRYCHR      FROMT     LEMMINGSMERRYC       ASFROM  EFLEMMINGS
MERRYCHR      FROMT     LEMMINGSMERRYC       ASFROMT EFLEMMINGS
MERRYCHRI      ROM     FLEMMINGSMERRYC       ASFROMTHEFLEMMIN S
MERRYCHRI      ROM     FLEMMINGSMERRYC       ASFROMTHEFLEMMI  S
MERRYCHRIS      O      EFLEMMINGSMERRYC       ASFROMTHEFLEMM   S
MERRYCHRIS             EFLEMMINGSMERRYC       ASFROMTHEFLE     S
MERRYCHRIST           HEFLEMMINGSME                           S
MERRYCHRIST           HEFLEMMINGSME                           S
MERRYCHRISTMASFROMTHEFLEMMINGSMERRYCHRISTMASFROMTHEFLEMMINGS

HELLO JOHN AND MARY,

   HERE WE ARE AGAIN WITH OUR ANNUAL SAGA.
   WE HOPE ALL IS WELL THERE IN DENVER.
.
.
.
                                                SO LONG FOR NOW,


GREETINGS TO THE SMITH'S,
   WELL MY COMPUTER AND I GOT TOGETHER AGAIN
THIS YEAR.  THIS IS BECOMING A TRADITION (AND
A VERY ENJOYABLE ONE).
.
.
.
HAPPY HOLIDAYS,JOHN AND MARY


                    1    9999    7777    9999
                    1    9  9      7     9  9
                    1    9999    7       9999
                    1       9    7          9
                    1    9999    7       9999
```

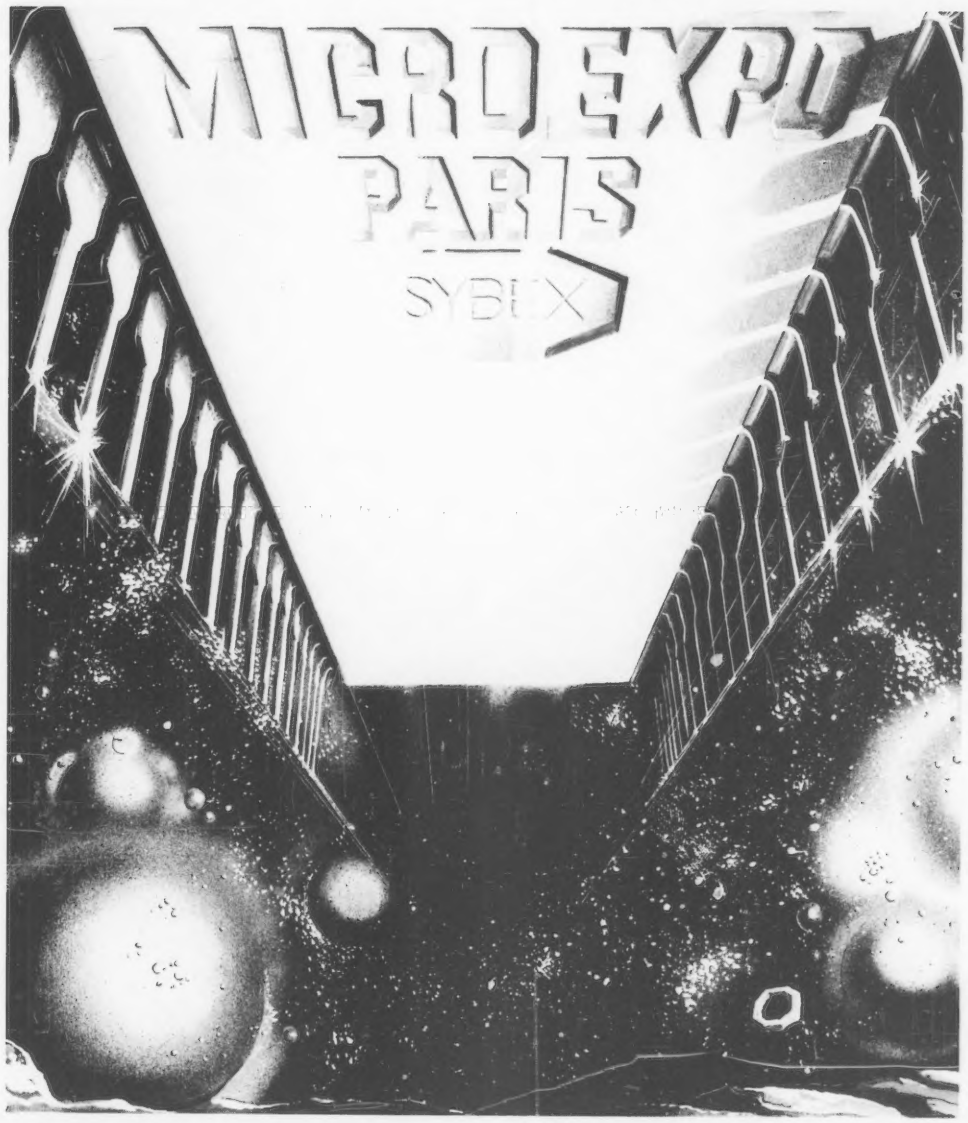
```
                JANUARY                    FEBRUARY                   MARCH

          .. 1  2  3  4  5  6        .. .. .. .. 1  2  3        .. .. .. .. 1  2  3
           7  8  9 10 11 12 13        4  5  6  7  8  9 10        4  5  6  7  8  9 10
          14 15 16 17 18 19 20       11 12 13 14 15 16 17       11 12 13 14 15 16 17
          21 22 23 24 25 26 27       18 19 20 21 22 23 24       18 19 20 21 22 23 24
          28 29 30 31 .. .. ..       25 26 27 28 .. .. ..       25 26 27 28 29 30 31

                APRIL                      MAY                        JUNE

           1  2  3  4  5  6  7        .. ..  1  2  3  4  5        .. .. .. .. .. 1  2
           8  9 10 11 12 13 14         6  7  8  9 10 11 12        3  4  5  6  7  8  9
          15 16 17 18 19 20 21        13 14 15 16 17 18 19       10 11 12 13 14 15 16
          22 23 24 25 26 27 28        20 21 22 23 24 25 26       17 18 19 20 21 22 23
          29 30 .. .. .. .. ..        27 28 29 30 31 .. ..       24 25 26 27 28 29 30

                JULY                      AUGUST                   SEPTEMBER

           1  2  3  4  5  6  7        .. .. ..  1  2  3  4        .. .. .. .. .. ..  1
           8  9 10 11 12 13 14         5  6  7  8  9 10 11        2  3  4  5  6  7  8
          15 16 17 18 19 20 21        12 13 14 15 16 17 18        9 10 11 12 13 14 15
          22 23 24 25 26 27 28        19 20 21 22 23 24 25       16 17 18 19 20 21 22
          29 30 31 .. .. .. ..        26 27 28 29 30 31 ..       23 24 25 26 27 28 29
          .. .. .. .. .. .. ..        .. .. .. .. .. .. ..       30 .. .. .. .. .. ..

                OCTOBER                   NOVEMBER                  DECEMBER

          .. 1  2  3  4  5  6        .. .. .. .. 1  2  3        .. .. .. .. .. ..  1
           7  8  9 10 11 12 13        4  5  6  7  8  9 10        2  3  4  5  6  7  8
          14 15 16 17 18 19 20       11 12 13 14 15 16 17        9 10 11 12 13 14 15
          21 22 23 24 25 26 27       18 19 20 21 22 23 24       16 17 18 19 20 21 22
          28 29 30 31 .. .. ..       25 26 27 28 29 30 ..       23 24 25 26 27 28 29
          .. .. .. .. .. .. ..       .. .. .. .. .. .. ..       30 31 .. .. .. .. ..
```

```
LAST NAME? JONES
FIRST NAMES? BILL AND SUSAN
THEIR CITY OR STATE? PHOENIX
CHILDRENS NAMES OR
TYPE 'NONE'? BILLY AND MARIE
PRINT HEADING (Y OR N)? N
PRINT CALENDAR (Y OR N)? N
PRINT BOTH LETTERS (Y OR N)? Y


HELLO BILL AND SUSAN,

   HERE WE ARE AGAIN WITH OUR ANNUAL SAGA.
   WE HOPE ALL IS WELL THERE IN PHOENIX.
   BILLY AND MARIE ARE YOU GETTING READY FOR
CHRISTMAS?  BRUCE AND BRIAN ARE EXCITED ABOUT
THE HOLIDAYS.
.
.
.
                                                SO LONG FOR NOW,


GREETINGS TO THE JONES'S,
   WELL MY COMPUTER AND I GOT TOGETHER AGAIN
THIS YEAR.  THIS IS BECOMING A TRADITION (AND
A VERY ENJOYABLE ONE).
.
.
.
HAPPY HOLIDAYS,BILL AND SUSAN
AND BILLY AND MARIE
```

MICRO/EXPO 79
PARIS

MAY 15 - 17

CENTRE INTERNATIONAL DE PARIS
4TH ANNUAL MICROCOMPUTER SHOW



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Dear Programmer:

Many companies are entering the software business today and promising amazing amounts of royalties based on ridiculous sales projections and pipe dreams. At *Creative Computing* we have a very straight-forward policy based on the current and future realities of the market.

1. We are seeking programs for:
   A. Radio Shack TRS-80
      i. Level I Basic 4k cassette
      ii. Level I Basic 16k cassette
      iii. Level II Basic 16k cassette
      iv. Level II Basic 16k floppy diskette
   B. Apple II, up to 16k, cassette and floppy diskette
   C. PET, 8k
   D. Sol-20, cassette
   E. Ohio Scientific Challenger IP and IIP
   F. Exidy Sorcerer

We have many other computers in our software center and our future line will broaden but these are the ones for which we intend our initial software releases.

2. Programs submitted should be complete, well documented, and on the medium (cassette or floppy) that they are to be released. Record *two* copies in case the tape has a dropout.

3. *Creative Computing* tapes and disks will contain five to ten programs each, preferably from one programmer.

4. *Creative Computing* software is thoroughly reviewed and, if necessary, refined in house. If extensive modifications are required, it is returned to the original programmer. We will let you know if we intend to use your program within 12 weeks, generally less. Please include 3 first class stamps with your submission for return of cassette or disk.

5. *Creative Computing* has contracted with popular, well-known writers of science fiction, adventure and educational books, movies and TV shows to enhance its software with humor, lively dialog and punchy graphics where necessary.

6. *Creative Computing* software is recorded by putting the programs on the appropriate computer, recording directly on a high-quality reel-to-reel recorder and filtering the signal for pure square waves. It is then recorded on the very finest quality, cassettes or disks. It is recorded twice, once on each side for maximum reliability.

7. Packaging includes two labels on each cassette, two-color box insert, instruction booklet and a Norelco-style hard plastic box. Disks are similarly labeled and packaged.

8. Cassettes retail for $7.95 and disks for $17.95. The programmer receives 10% of the list (retail) price. An advance royalty on the sales of the first 100 units is paid *on acceptance* (on a tape cassette this amounts to $79.50 at the time the programs are accepted, not months later.) If more than one programmer is represented on a cassette, royalties are apportioned proportionately.

9. *Creative Computing* provides retail dealers with attractive, high-quality wood and plexiglass display cabinets for software, point-of-sale posters and literature so sales will be as much or more as with any other supplier.

10. *Creative Computing* also advertises its software in many magazines, not just *Creative Computing*, hence broadening the market. We also exhibit at shows such as the Consumer Electronics Show to further extend the market for *Creative Computing* software.

Creative Computing today has a line of software more comprehensive and professional than virtually any manufacturer or software supplier. If your programs qualify, we would be pleased to add them to our line.

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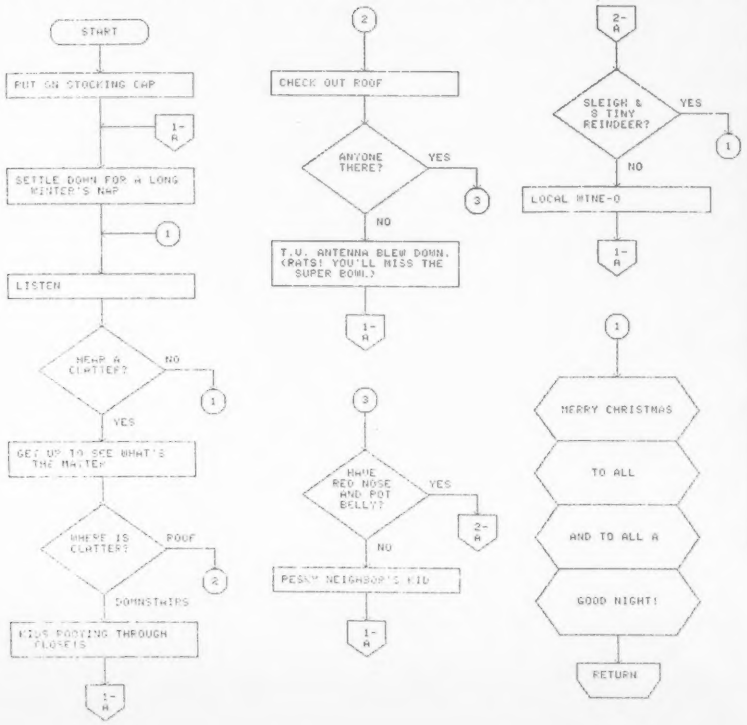

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creative computing

1. In addition to BASIC, which computer language would you prefer that Creative Computing use for publication of computer programs? (check *one* only)

   a ☐ APL d ☐ PL/I g ☐ COBOL
   b ☐ FORTRAN e ☐ PASCAL h ☐ RPG
   c ☐ ALGOL f ☐ ASSEMBLER i ☐ SNOBOL

2. In which types of programs are you most interested? (check all that apply.)

   1 ☐ Simulations, complex games, AI, etc.
   2 ☐ Short, imaginative games
   3 ☐ Personal applications programs (personal Finance, record keeping, etc.)
   4 ☐ CAI programs
   5 ☐ Business programs (mailing lists, accounts payable, etc.)

3. What's the longest program that you will use? (check one only)

   a ☐ under 50 lines d ☐ under 500 lines
   b ☐ under 100 lines e ☐ over 500 lines
   c ☐ under 250 lines

4. In Future issues would you like to see the pages of Creative Computing devoted to: (check one only.)

   a ☐ more programs b ☐ same percentage of programs
   c ☐ fewer programs

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121	122	123	124	125	196	197	198	199	200
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131	132	133	134	135	206	207	208	209	210
136	137	138	139	140	211	212	213	214	215
141	142	143	144	145	216	217	218	219	220
146	147	148	149	150	221	222	223	224	225
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166	167	168	169	170	241	242	243	244	245
171	172	173	174	175	246	247	248	249	250

creative computing

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   b ☐ FORTRAN e ☐ PASCAL h ☐ RPG
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   a ☐ under 50 lines d ☐ under 500 lines
   b ☐ under 100 lines e ☐ over 500 lines
   c ☐ under 250 lines

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   a ☐ more programs b ☐ same percentage of programs
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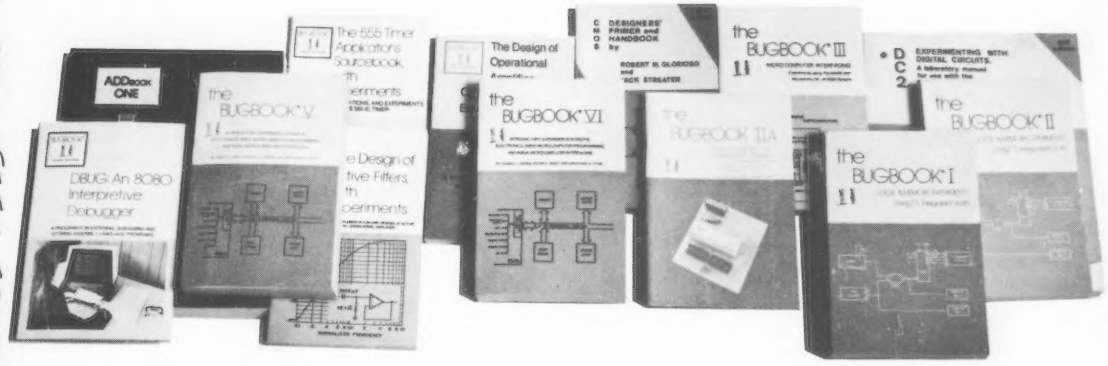

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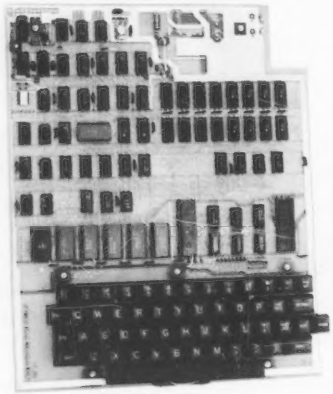

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